

Preliminary Report

FUNDAMENTAL STUDIES OF RADAR SCATTERING
FROM WATER SURFACES

The Lake Washington Experiment

NAGW-1278

A. Salam, D. Bush, S. Gogineni & A. Zaide

Radar Systems and Remote Sensing Laboratory
University of Kansas Center for Research, Inc.
2291 Irving Hill Road
Lawrence, Kansas 66045-2969
913/864-4835

FAX: 913/864-7789 * OMNET: KANSAS.U.RSL * TELEX: 706352

RSL Technical Report 7970-2

December 1991

Supported by:

NASA Headquarters
Washington DC 20546

Grant NAGW-1278

Table of Contents

Abstract	1
Introduction	3
Radar Systems	5
Tables 1 and 2	6
Experiment Description	7
Description of the Data	9
Data Analysis	11
Calculation of Normalized Radar Cross Section (σ^0)	11
Calculation of the MTF	13
Appendix A	
Plots of Backscattered Power and Wave Height	
1. C Band	15
2. X Band	83
3. Ka Band	157
Appendix B	
Plots of σ^0 and Wave Height	
1. C Band	183
2. X Band	211
3. Ka Band	239
Appendix C	
Plots of PSD, MTF, Coherence Function and Cross-Correlation Function for Wave Height and Radar Return Power	
1. C Band	265
2. X Band	307

Abstract

The University of Kansas and the University of Washington conducted a series of experiments during July and August of 1989, and July and August of 1990, to study the effects of various geophysical parameters on radar backscatter. The experiments were conducted from a platform in Lake Washington. Measurements of backscattered power and radar range were made by the University of Kansas, and environmental data such as wind speed, wind direction, air and water temperature were measured by the University of Washington. Results of preliminary data processing are described here.

Radar data were acquired using two radars, one that operated at C and X bands and another at Ka band. Measurements were made at VV and HH antenna polarizations, at different angles of incidence and under various wind conditions. Plots of backscattered power, normalized radar cross section (σ^0), and wave height, and the Modulation Transfer Functions of selected data are presented.

Introduction

The Lake Washington Experiment was a three-year joint experiment between the Radar Systems and Remote Sensing Laboratory of the University of Kansas and the Atmospheric Sciences Department of the University of Washington. It took place from January 1988 to December 1990. The primary objectives of the experiment were to study the influence of various geophysical parameters on the backscattered signals and to check the validity of existing theories of radar backscatter from oceans.

Radar backscatter from water bodies has been studied in considerable detail, especially backscatter from wave tanks and oceans using a radar located on a tower. The tower-based studies have been used to develop theories and models that could be applied to radars on aircraft or spacecraft. The conditions in wave tanks are unrealistic and bear little resemblance to those encountered in the open sea. Tower-based measurements of radar backscatter also suffer from drawbacks. Tower-based experiments are usually major expeditions of relatively short duration, involving several investigators with different goals. The time scales are rigid, and coordination of the efforts of a large number of experimenters can be difficult. Since the expeditions are usually of short duration, the environmental conditions over which measurements are made are dictated by nature rather than choice. The Lake Washington Experiment was envisioned as an intermediate step between the laboratory and a tower in the open sea, since the restrictions associated with towers in open sea could be avoided, while conditions that are considerably more realistic and closer to conditions in the open sea than those possible in a wave tank could still be provided.

During the experiment, simultaneous measurements of radar range and backscattered power were made at C band and X band in July and August of 1989, and at Ka band in July and August of 1990. Measurements were made at VV and HH polarizations in the up-wind and cross-wind antenna look directions. Results of preliminary data processing are presented as time series of backscattered power, σ^0 , and wave height, along with the Modulation Transfer Function (MTF) for selected runs. Plots of the backscattered power and wave height are in Appendix A; those of σ^0 and wave height are in Appendix B, and plots of the MTF are in Appendix C.

Radar Systems

For the experiment, two different radar systems were developed. One was a frequency modulated continuous wave (FM-CW) radar operating on C band (6.0 GHz) and X band (11.0 GHz) simultaneously, capable of VV, HH, HV, and VH polarizations, and an FM-CW radar operating on Ka band, capable of VV and HH polarizations. The specifications of the C-and X-band system are given in Table 1 and those of the Ka-band system are given in Table 2.

PRECEDING PAGE BLANK NOT FILMED

Radar Type	FM-CW
Frequencies	6.0, 11.0 GHz
Transmit Power	10 mW
Polarizations	VV, HH, HV, VH
FM sweep width	C-band: 850 MHz X-band: 810 MHz
Modulation rate	70 Hz
Calibration	Internal: Delay line External: Luneburg lens
Antenna	0.75 m. Parabolic dish with offset feed
Beamwidth in elevation	C-band: 12.7° X-band: 8.5°
Beamwidth in azimuth	C-band: 5.0° X-band: 3.0°
Sampling period	65.6 msec

Table 1. C-band/X-band radar specifications

Radar Type	FM-CW
Frequency	34.0 GHz
Transmit Power	1 mW
Polarizations	VV, HH
FM sweep width	234 MHz
Intermediate frequency	30 KHz
Calibration	Internal: Delay line External: Metal Sphere
Antenna	Tx : 0.30 m Parabolic dish Rx : collimating horn lens
Beamwidth in Tx	1.9°
Beamwidth on Rx	8.0°
Sampling period	100 msec

Table 2. Ka-band radar specifications

Experiment Description

During the Lake Washington Experiment, simultaneous recordings were made of radar backscattered power and radar range by the University of Kansas, while measurements of wire-gauge wave height, wind speed, wind direction, air and water temperature were made by the University of Washington. A video camera was used during some of the runs and provided a visual record of the activity within the radar footprint. The radar was mounted on a platform at a 5-meter height, and the camera was mounted below it at 1.5 meters, which allowed for a small footprint area and close-up observation.

The steady wind direction and wind speed at Lake Washington produce wave structures that are relatively simple compared to the open sea. The dominant wave is usually well defined, and wave height is typically 0.3 meters from trough to crest and rarely exceeds 0.6 meters. Occasional spilling breakers are observed above wind speeds of 4 m/s. During the period of observation, wind speeds ranged from 2 m/s - 7 m/s. Although 60 hours of data are available, 2 hours of which have video, the quality of data acquired during the initial days of the experiment is poor. These data have not been included in this report.

Description of the Data

Measurements were made at all three frequencies, under different environmental conditions. VV and HH polarizations were used, and the angle of incidence varied from 30° to 60°. Most of the measurements were made in the up-wind and cross-wind antenna look directions, with a few in between. The C-band and X-band data were sampled at 65.6 milliseconds/sample, with each run lasting 5 minutes. The Ka-band data were sampled at 100 milliseconds/sample, and the run length was either 5 or 10 minutes. Sampled backscattered power, slant range converted to wave height, normalized radar cross section (σ^0) and the Modulation Transfer Functions (MTFs) of selected runs are included in this report. Low frequency noise was observed in some of the wave height series, and this has been filtered out. The MTFs have been calculated using two methods, one in which "sea spikes" are included in the backscattered signal, and another method that uses a moving-average threshold method to detect sea spikes and remove them from the data. This technique of spike removal usually enhances the coherence between the backscattered power and wave height around the spectral peak in the wave height series. A short description of the method of calculation of σ^0 and MTFs is given in the Data Analysis section.

PRECEDING PAGE BLANK NOT FILMED

Data Analysis

σ^0 have been calculated for the data included in this report. A few plots showing the instantaneous σ^0 and wave height can be found in Appendix B. The MTF of some runs have also been calculated, and plots of these are in Appendix C. The runs for the computed MTFs were selected on the basis of the stability of environmental conditions, shown by one major spectral peak in the wave height signal. Brief descriptions of the calculation of σ^0 and the MTF follow.

Calculation of Normalized Radar Cross Section (σ^0)

The radar equation is given by

$$P_r = \frac{P_t G_t G_r \lambda^2 \sigma}{(4\pi)^3 R^4}$$

where P_r is the received power, P_t the transmitted power, λ the transmitted wavelength, σ the radar cross section of the target and R the range to the target, G_t the gain of the transmit antenna, G_r the gain of the receive antenna. Hence σ is given by

$$\sigma = \frac{(4\pi)^3 R^4 P_r}{P_t G_t G_r \lambda^2}$$

The normalized radar cross section, σ^0 , which represents radar cross section per unit area, is given by

PRECEDING PAGE BLANK NOT FILLED

$$\sigma^0 = \frac{(4\pi)^3 R^4 P_r}{P_t G_t G_r \lambda^2 A_{ill}}$$

where A_{ill} is the area illuminated by the radar beam. The illuminated area is a function of the antenna beamwidth, the geometry of the surface and the angle of incidence among other parameters.

σ and σ^0 can be calculated without direct determination of the antenna gains, the transmitter power and wavelength. If P_{cal} and R_{cal} are the power returned and range to a calibration target of a known radar cross section, then

$$\sigma_{cal} = \frac{(4\pi)^3 R_{cal}^4 P_{cal}}{P_t G_t G_r \lambda^2}$$

and

$$\sigma^0 = \frac{\sigma_{cal} R^4 P_r}{P_{cal} R_{cal}^4 A_{ill}}$$

P_r and R were measured during the field experiment while P_{cal} and R_{cal} were measured during the calibration process. σ_{cal} is known.

For each sample on the backscattered signal, the instantaneous σ^0 was calculated and averaged over a five-minute period (the length of the run) to obtain the mean value of σ^0 . Several time histories of σ^0 are presented in Appendix B.

Calculation of the MTF

The linear Modulation Transfer Function (MTF) describes the modulation of the backscattered power by long waves. It is complex since it describes both the amplitude of the modulation and the phase with respect to the long waves. The MTF aids in the interpretation of ocean images from active microwave radars and in determining the modulation of ripples by the long waves on which they appear.

The MTF is defined by

$$M(f) = \frac{G_{PW}(f)}{\bar{p}kG_{WW}(f)}$$

where $G_{PW}(f)$ is the cross spectrum of power and wave height, $G_{WW}(f)$ is the auto spectrum of the wave height, \bar{p} is the average received power, k is the long wave number and f is the long wave frequency.

The coherence function is given by

$$\gamma^2(f) = \frac{|G_{PW}(f)|^2}{G_{PP}(f)G_{WW}(f)}$$

Only those points for which the coherence between the backscattered power and wave height is greater than 0.25 are plotted.

The MTF is defined based on the assumption that there is a linear dependence between the long waves and the backscattered signal. "Sea spikes," or bursts in the backscattered signal seen in the time histories of backscattered power, make a significant contribution to the non-linearity of

the backscattered power. The removal of spikes from the backscattered signal should produce a better estimate of the MTF. To test this, MTFs were calculated using two methods, one in which the original backscattered signal was used and another in which the spikes were removed from the signal. Preliminary results show that spike removal improves the coherence between the backscattered power and wave height signal.

MTFs have been calculated for the C-band/X-band data. For the calculations, the wave height and power series were decimated by four to achieve an effective sampling rate of 3.8 Hz. The record length was then 1114 points. This was divided into 10 segments of 114 points each (approximately 30 seconds). Each segment was FFTed and accumulated to produce the spectra of the wave height and power signal. Spike removal was done before the decimation for the calculation for the MTF without spikes. Plots of the MTF for selected runs, with the original power signal and with the spikes removed, are presented in Appendix C.

Appendix A

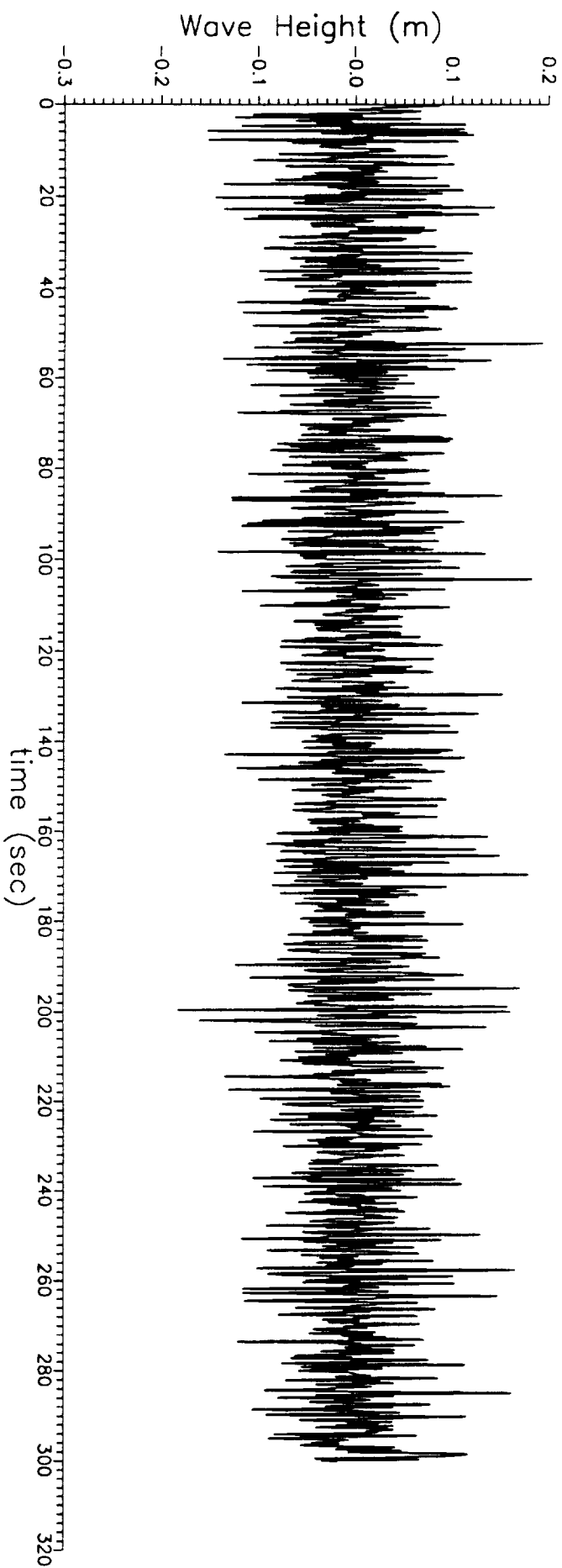
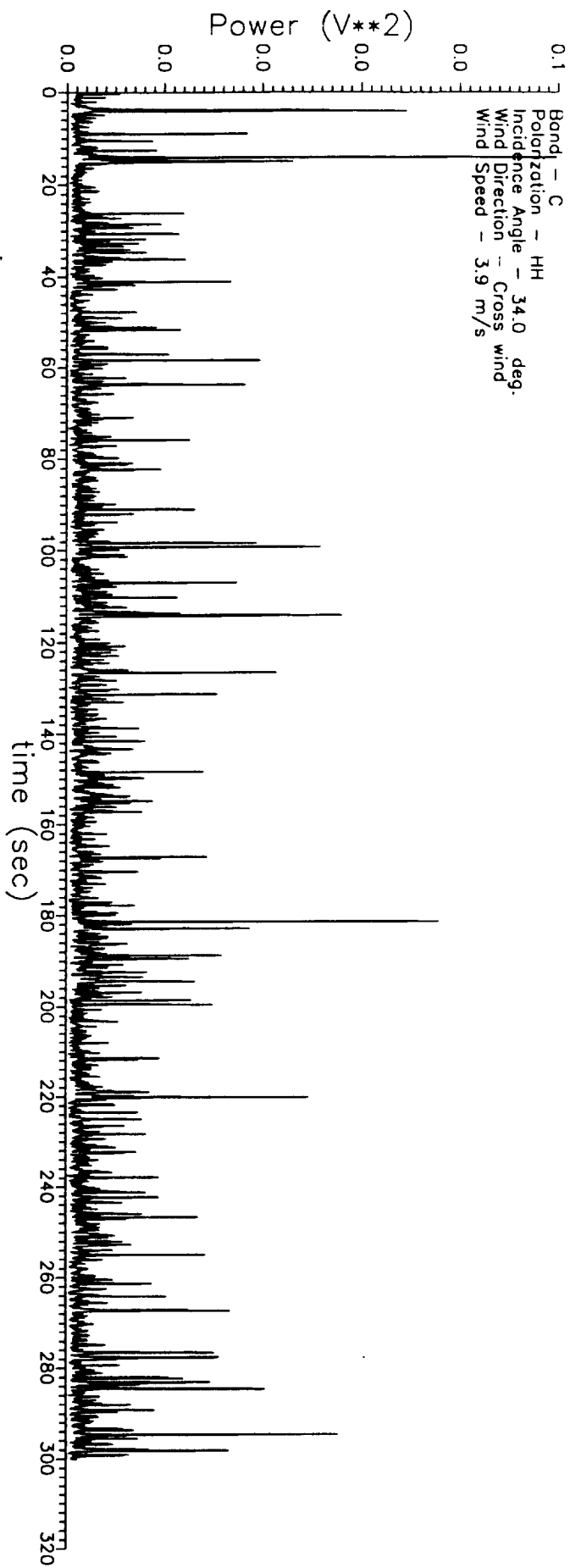
Plots of Backscattered Power and Wave Height

A-1. C Band



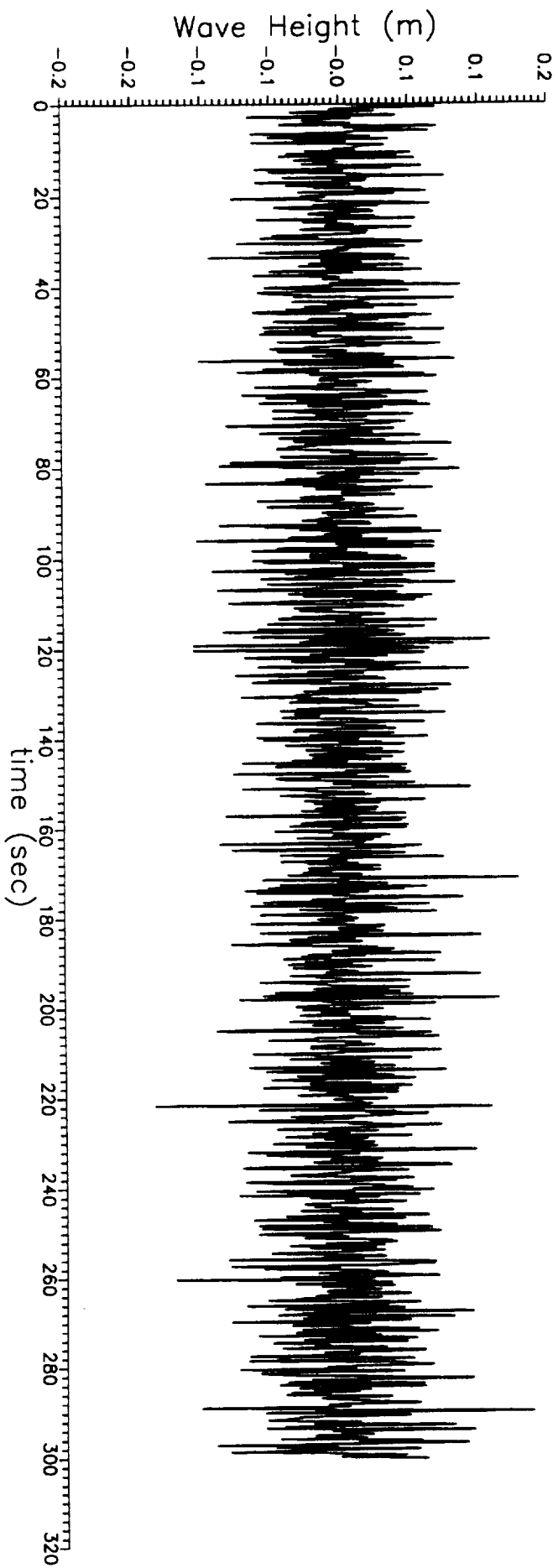
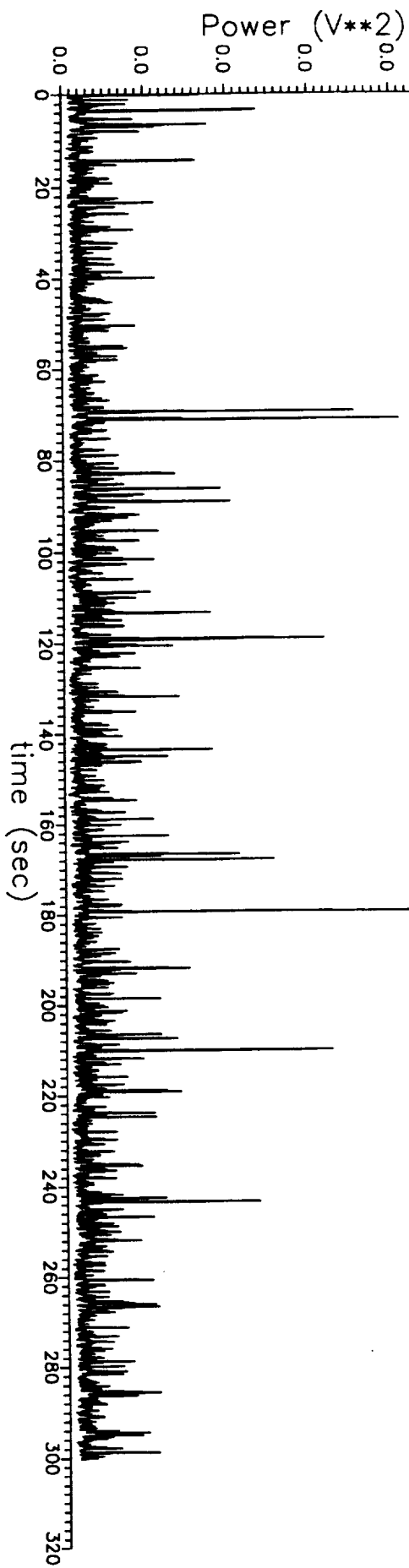
Run 1, 11:45, July 12, 1989

Band - C
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 3.9 m/s



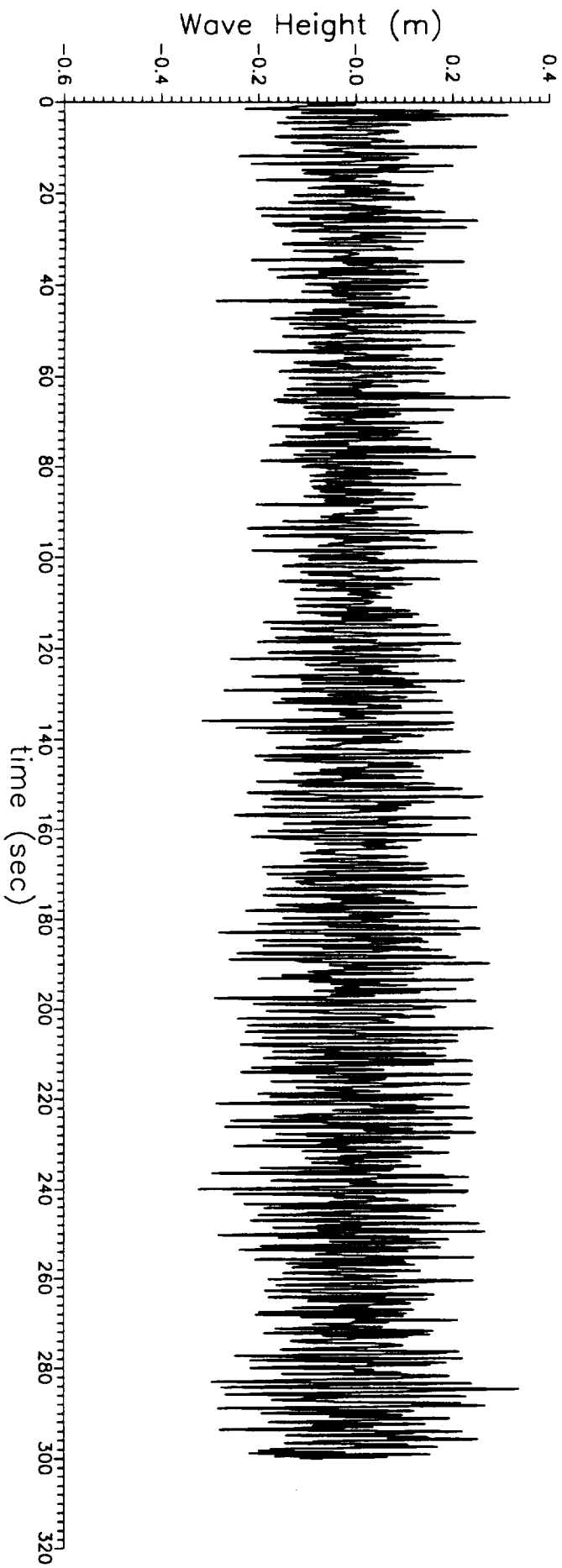
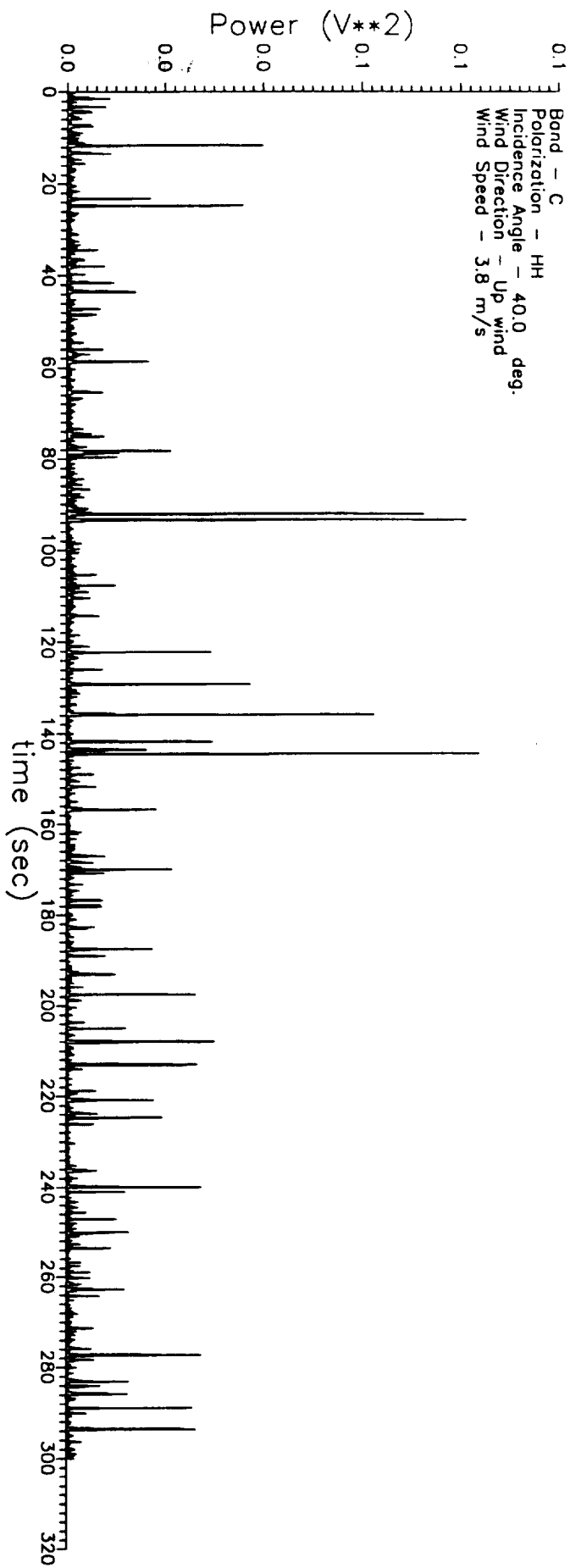
Run 2, 11:55, July 12, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 3.8 m/s

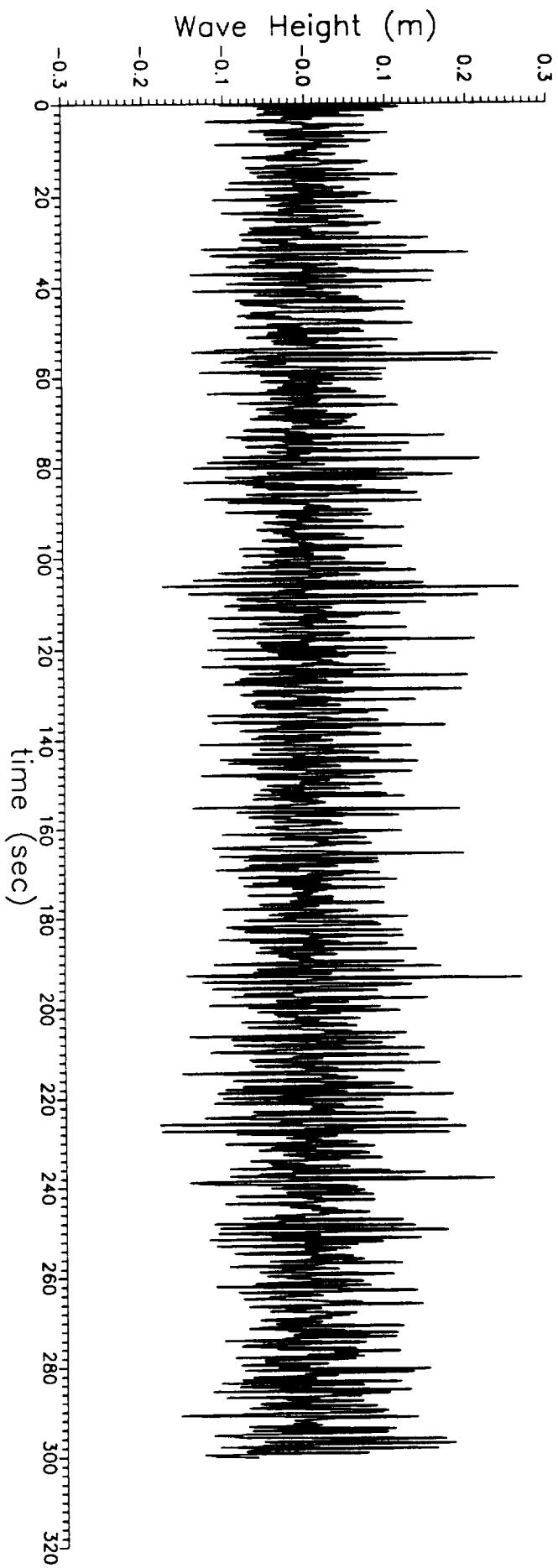
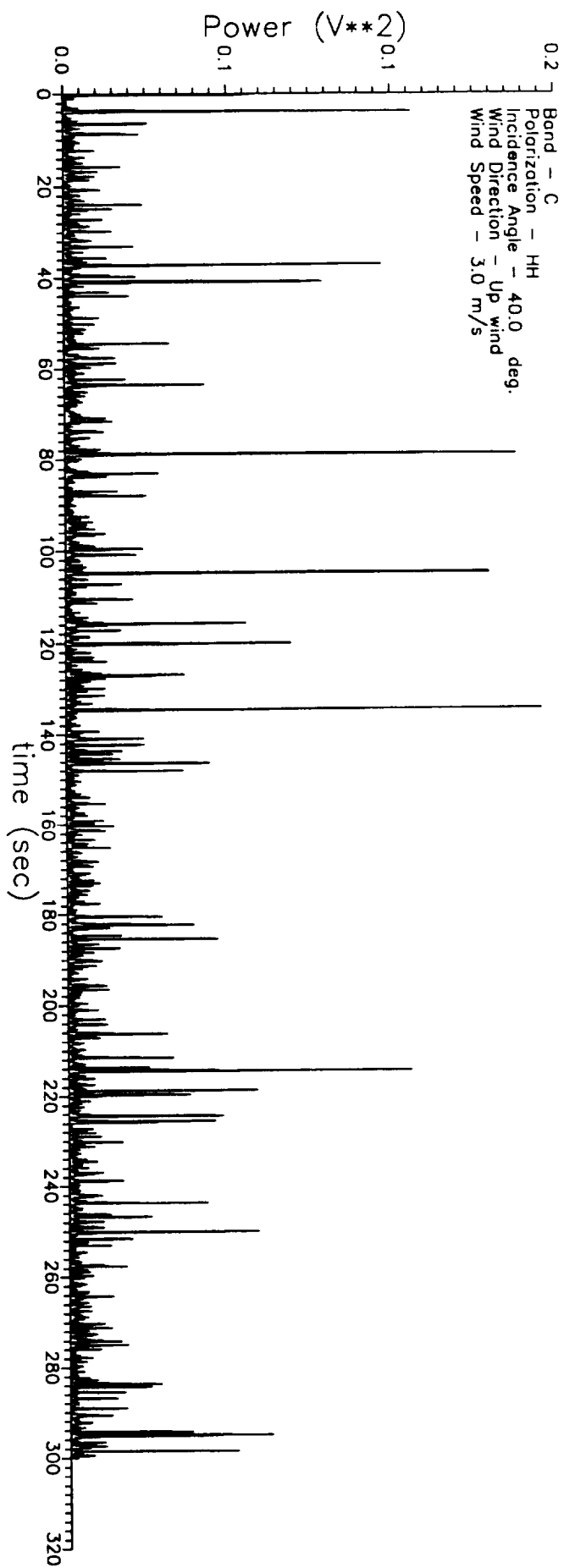


Run 16, 15:03, July 12, 1989

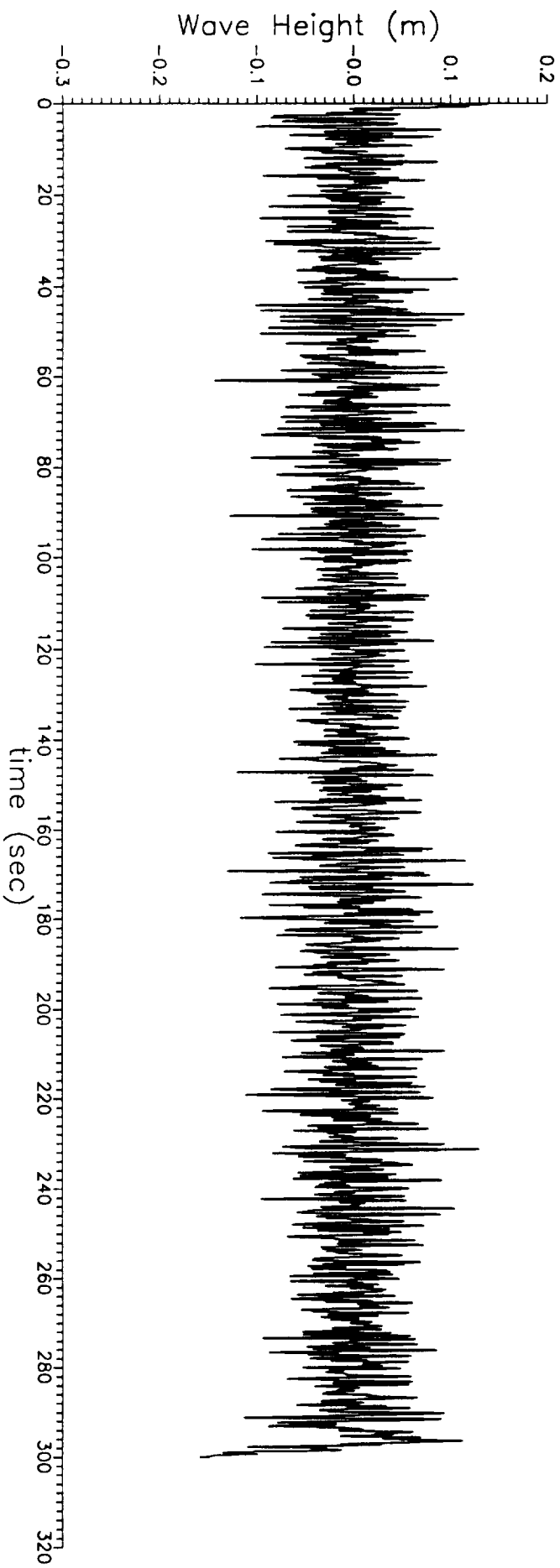
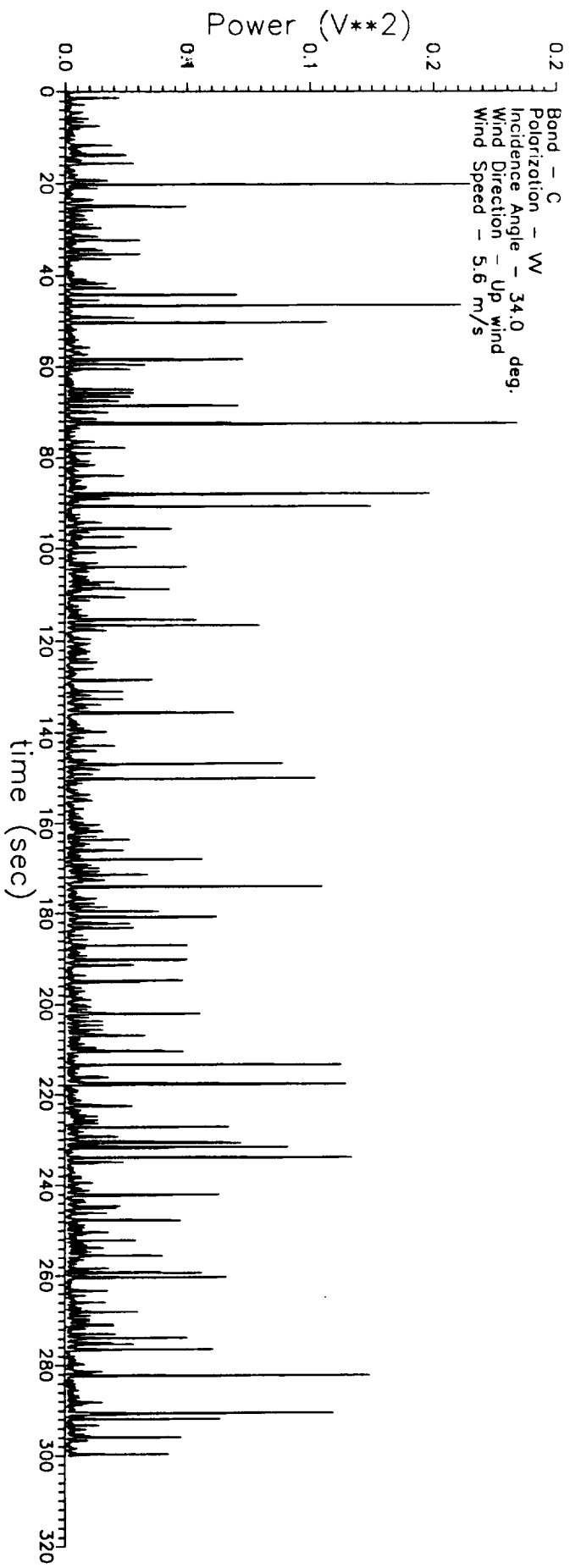
Band - C
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 3.8 m/s



Run 22, 15:56, July 12, 1989

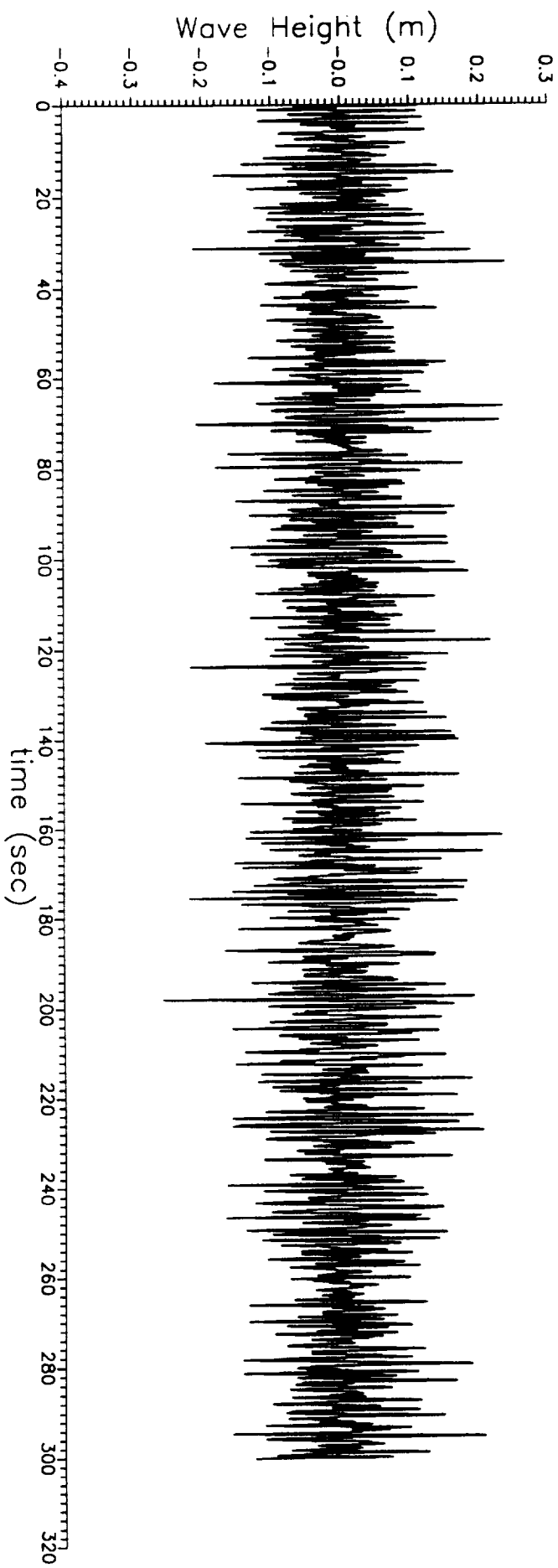
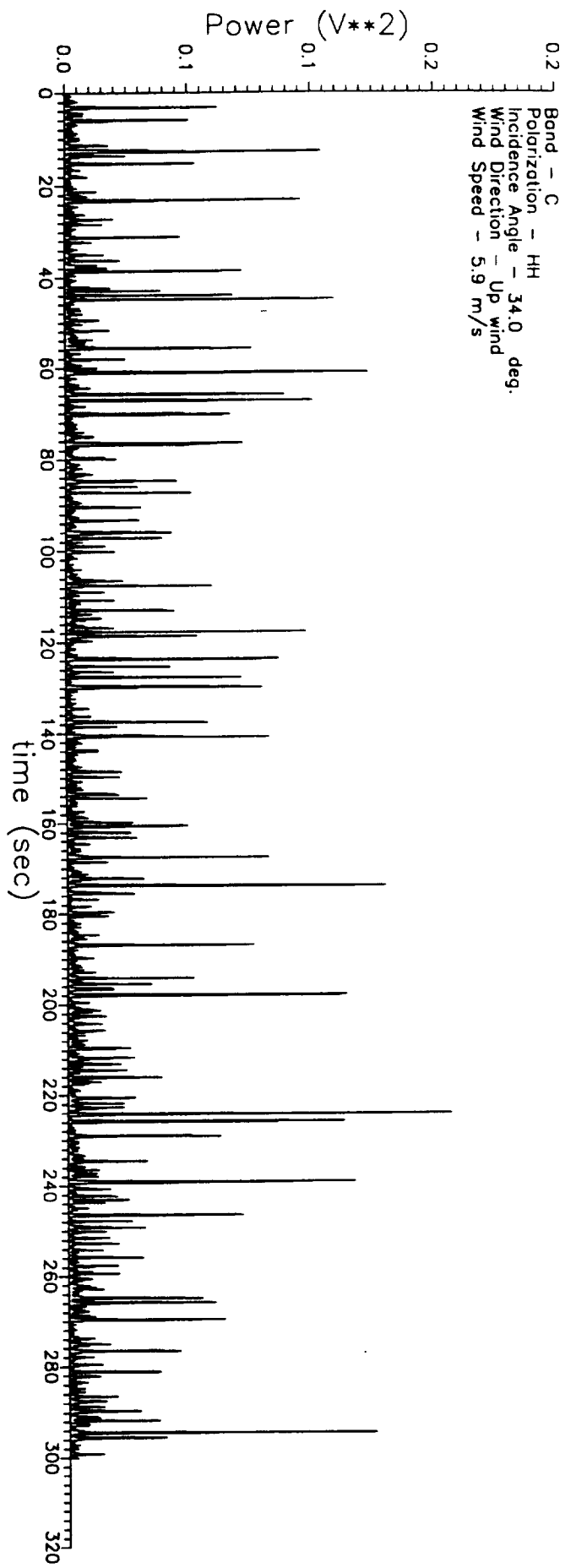


Run 6, 17:05, July 19, 1989



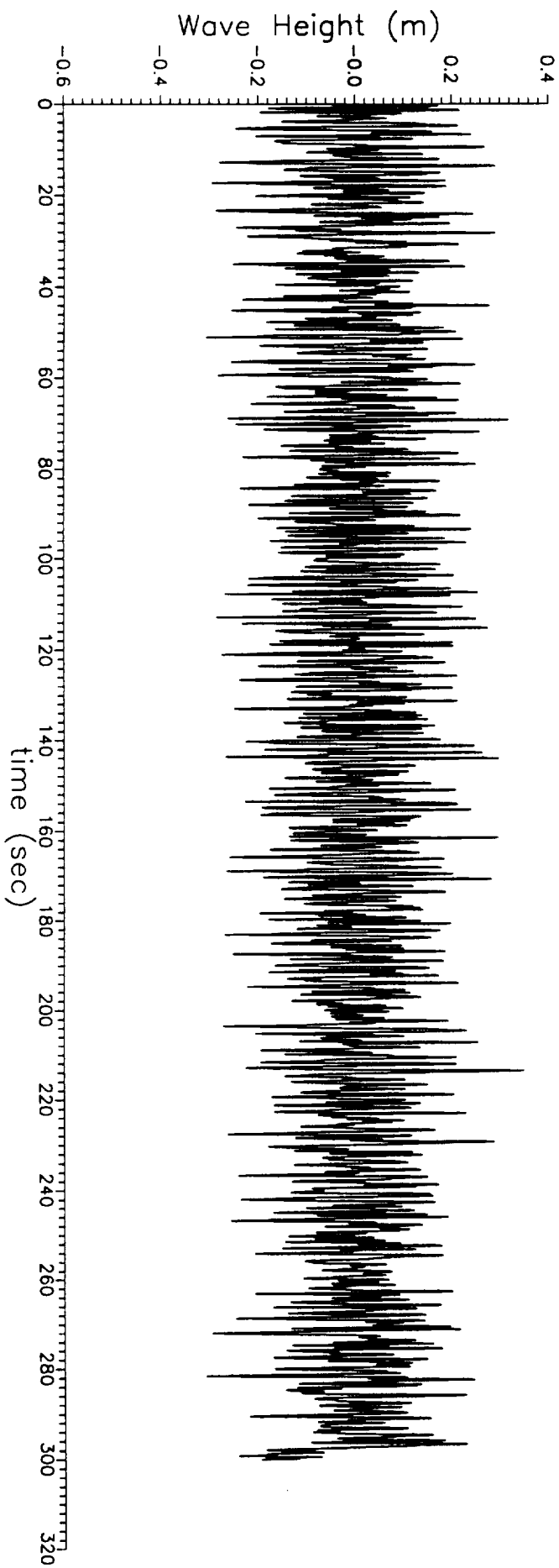
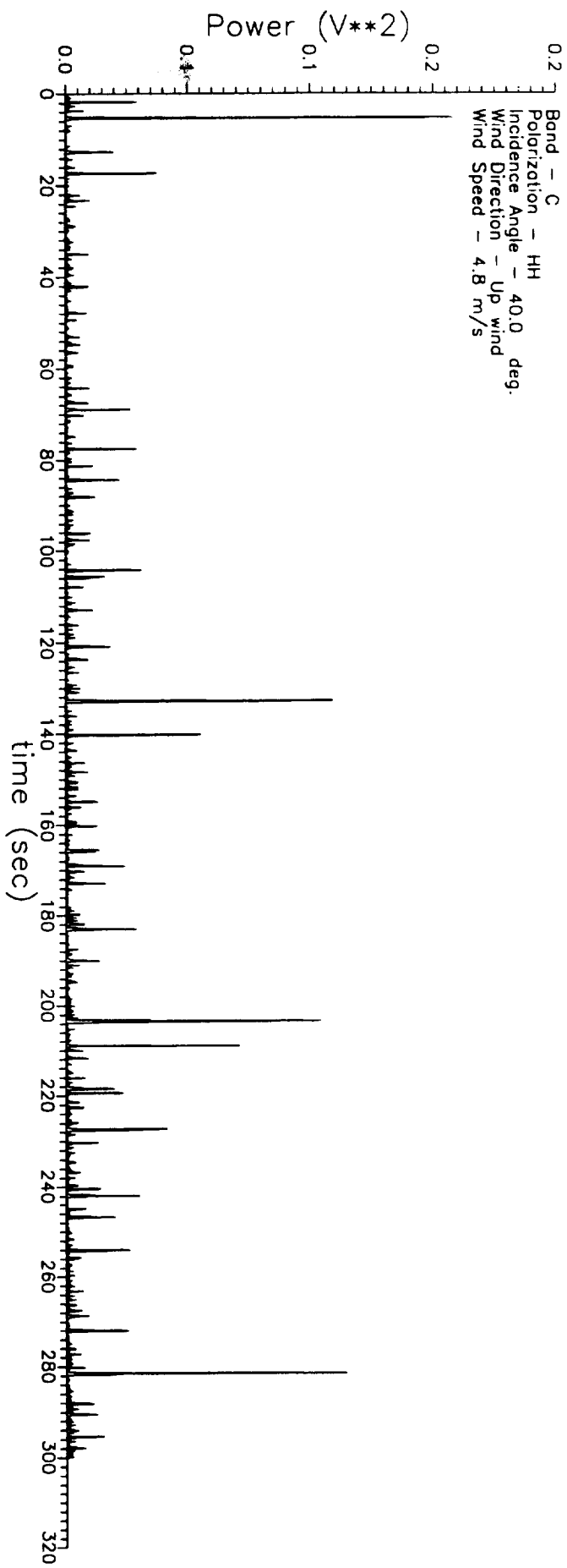
Run 7, 17:13, July 19, 1989

Band - C
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 5.9 m/s



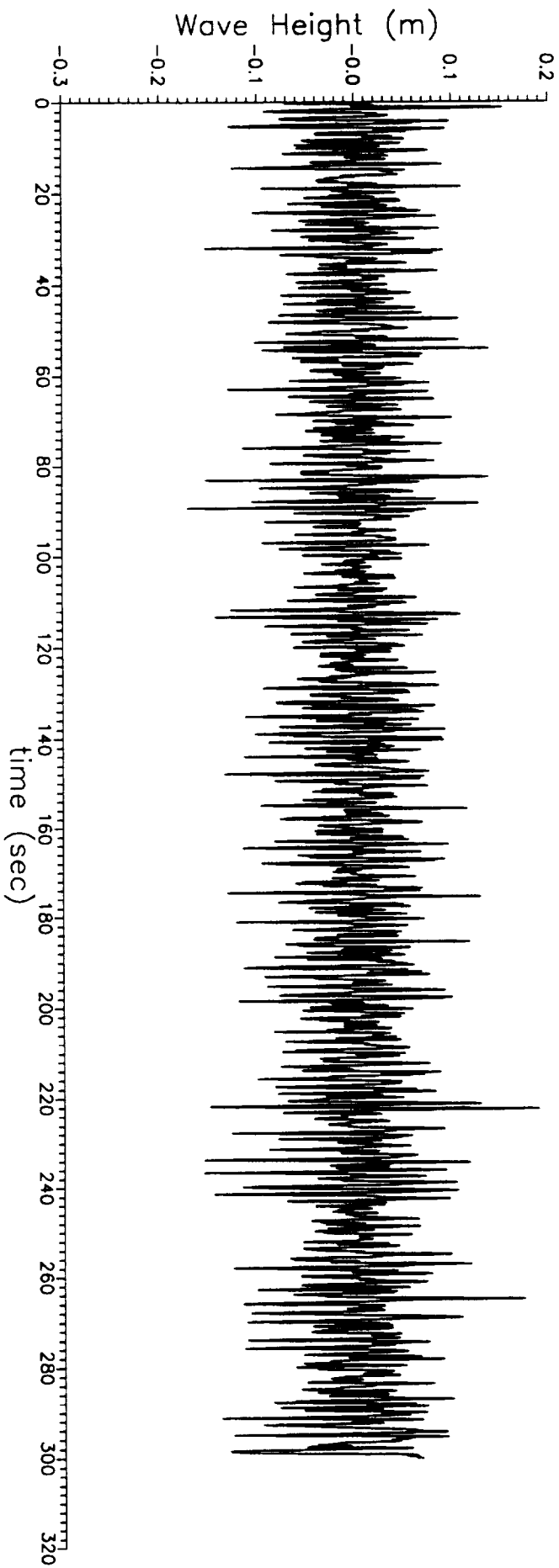
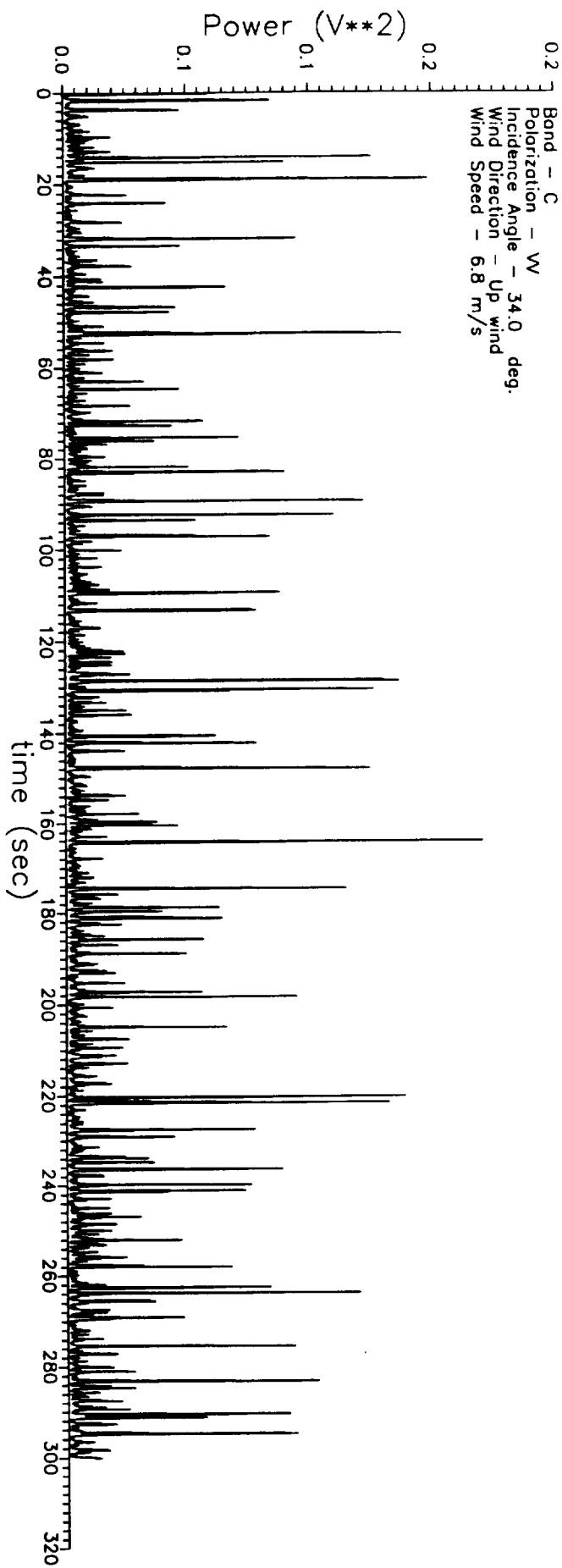
Run 8, 17:19, July 19, 1989

Band - C
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s



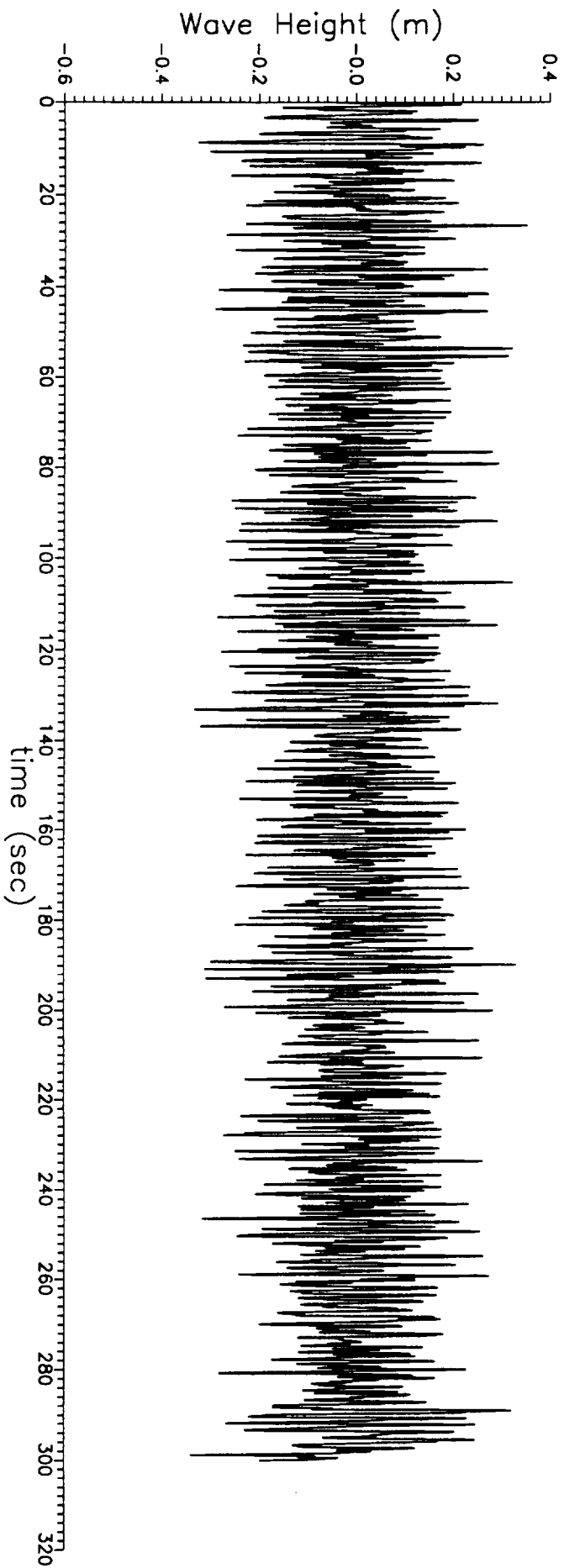
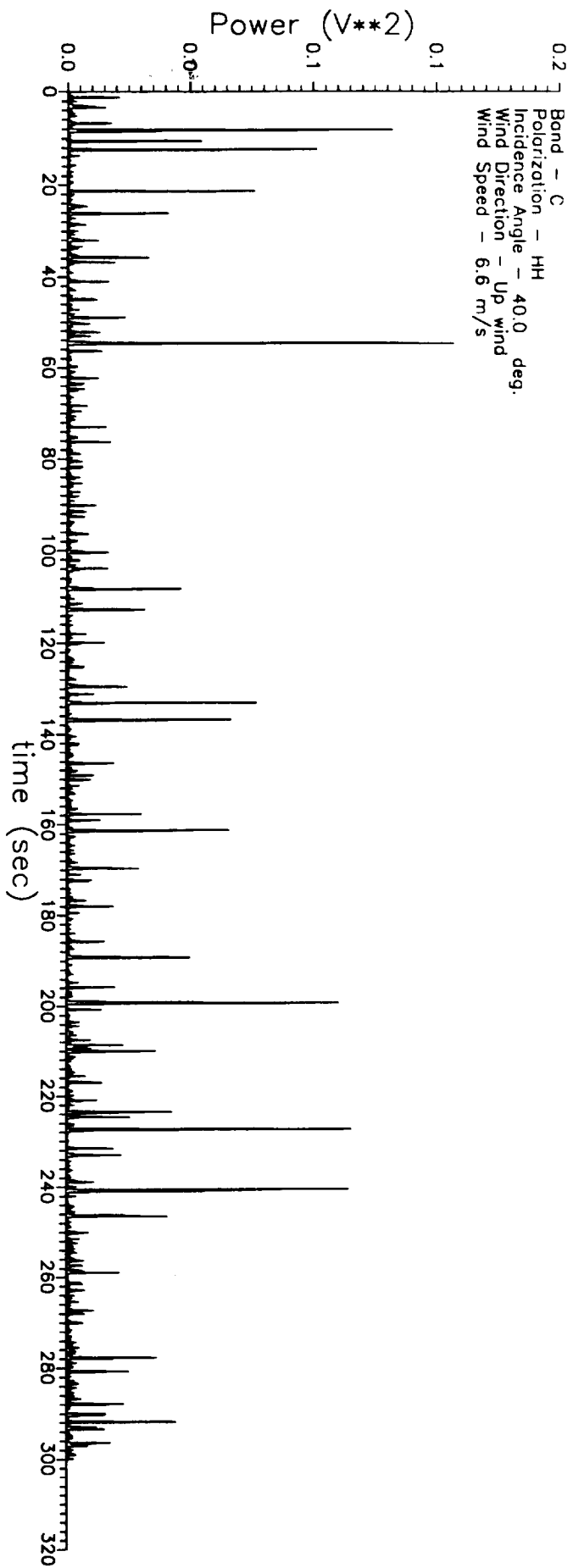
Run 12, 17:45, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 6.8 m/s



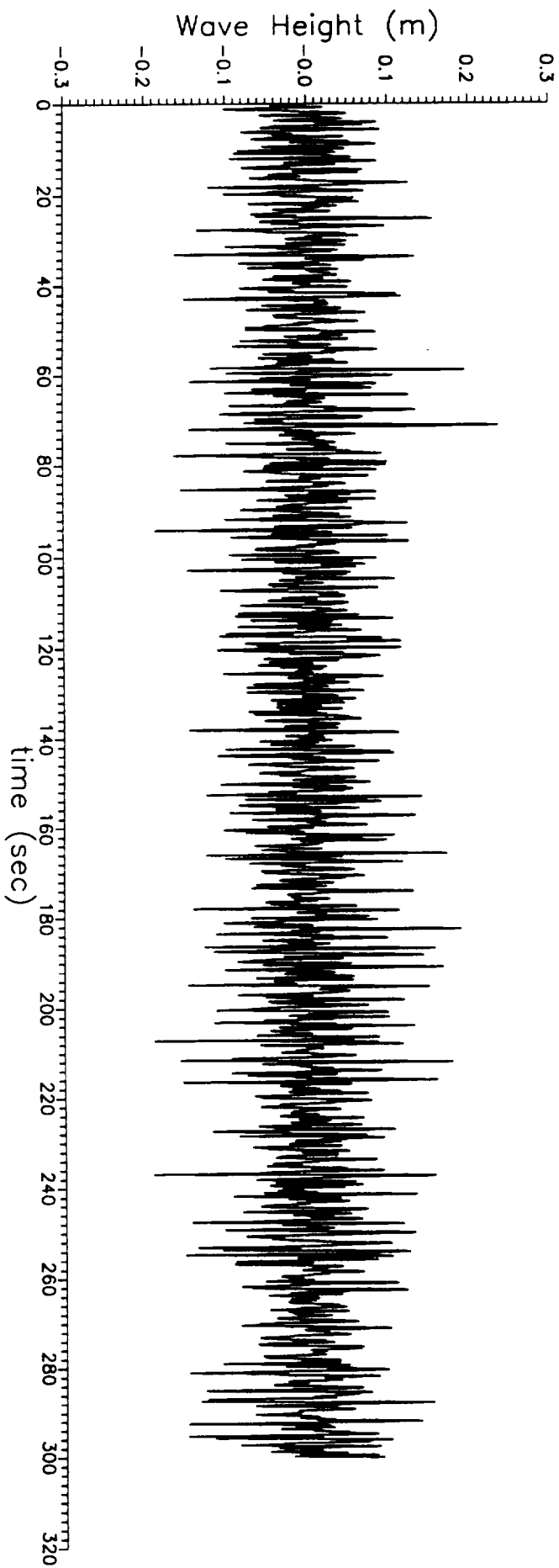
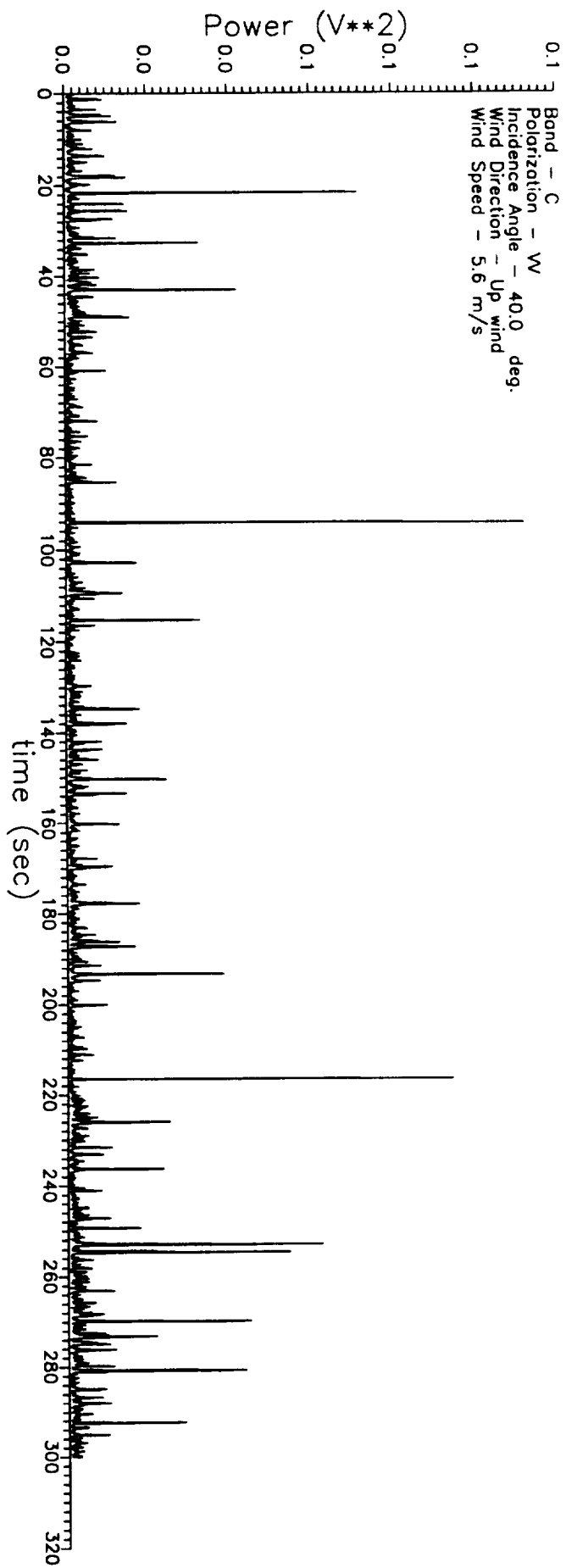
Run 13, 17:55, July 19, 1989

Band - C
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



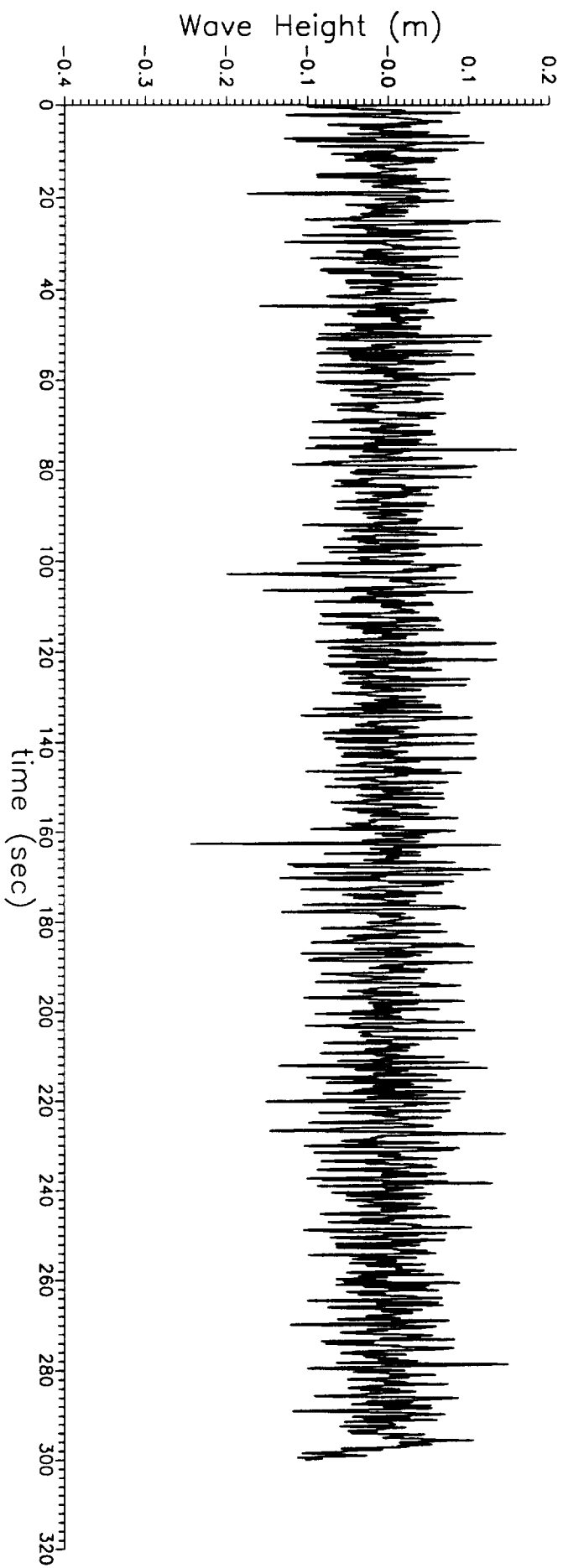
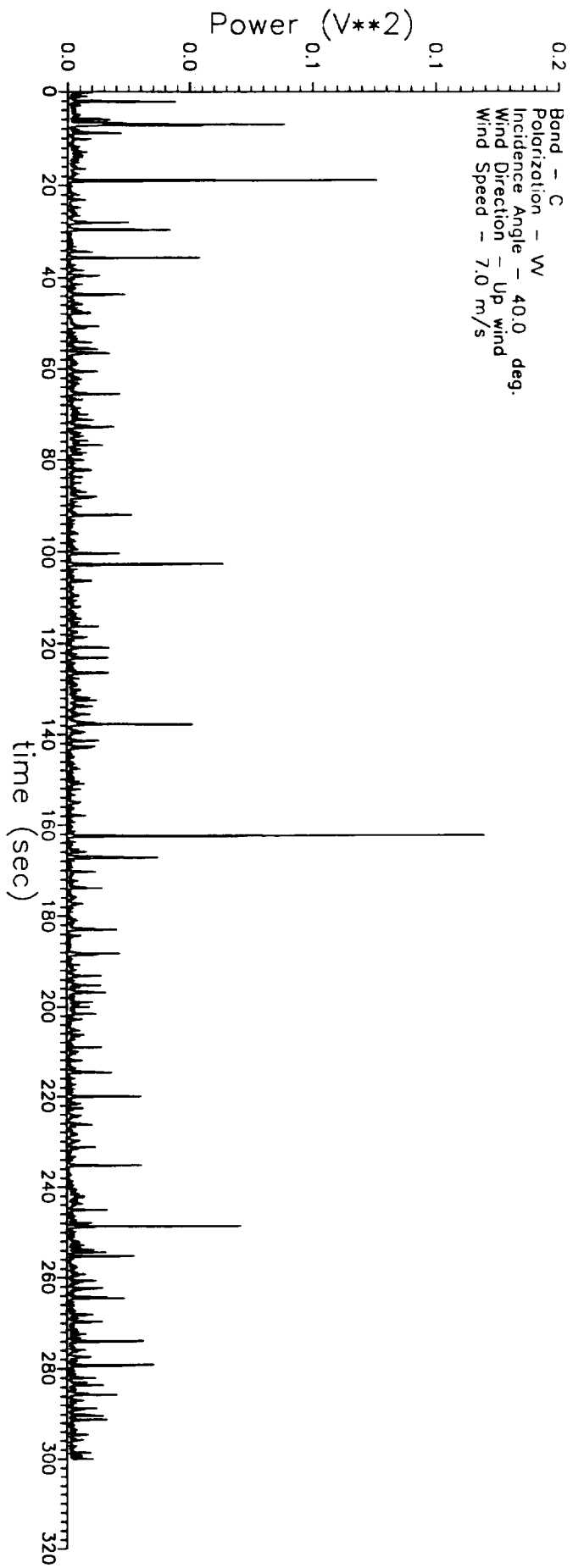
Run 15, 18:11, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.6 m/s



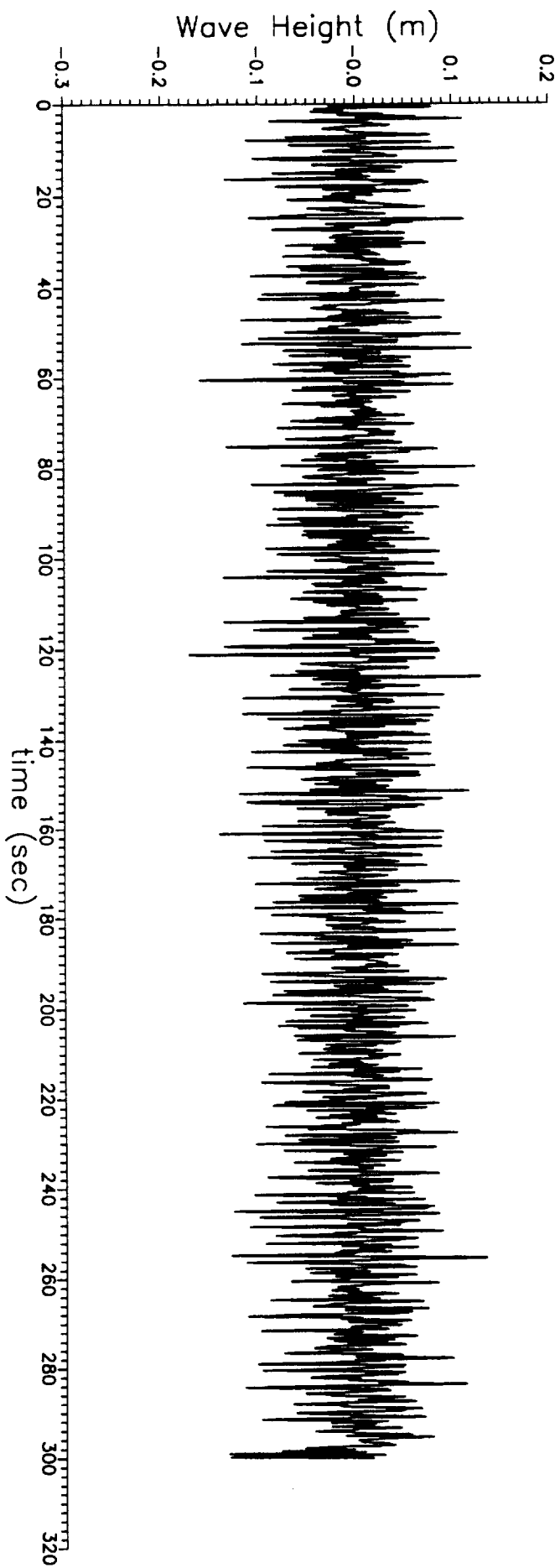
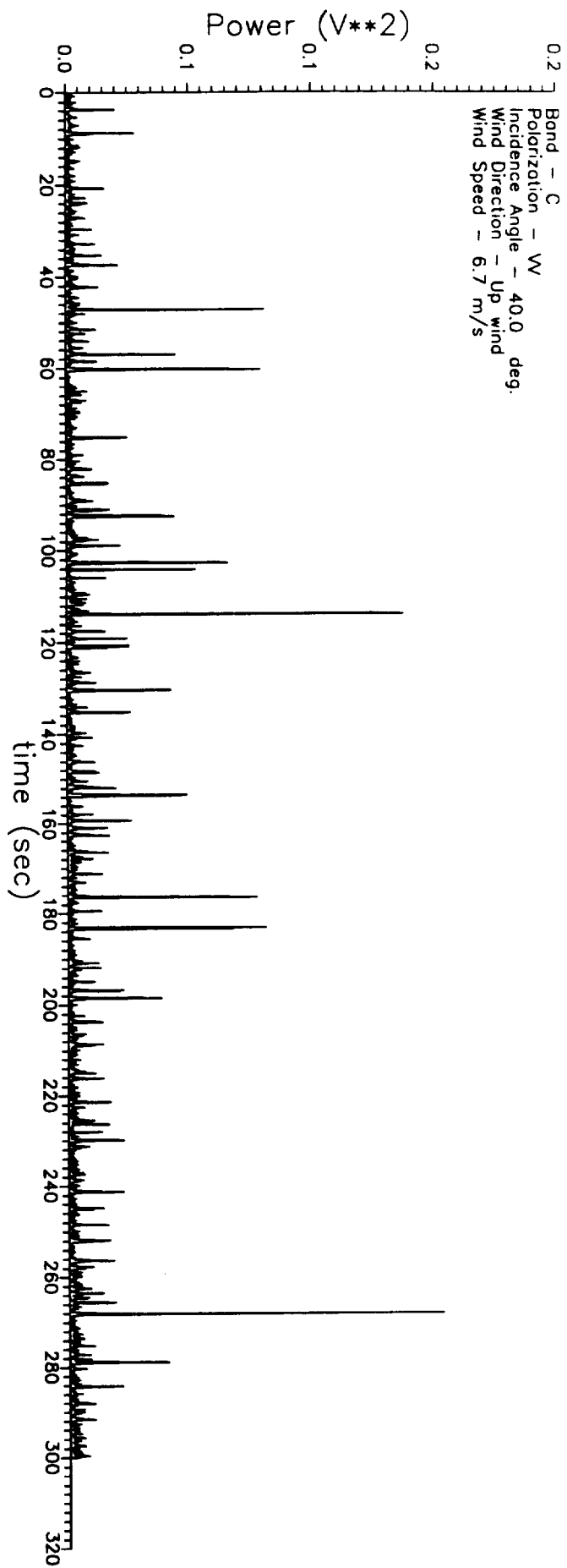
Run 16, 18:17, July 19, 1989

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.0 m/s

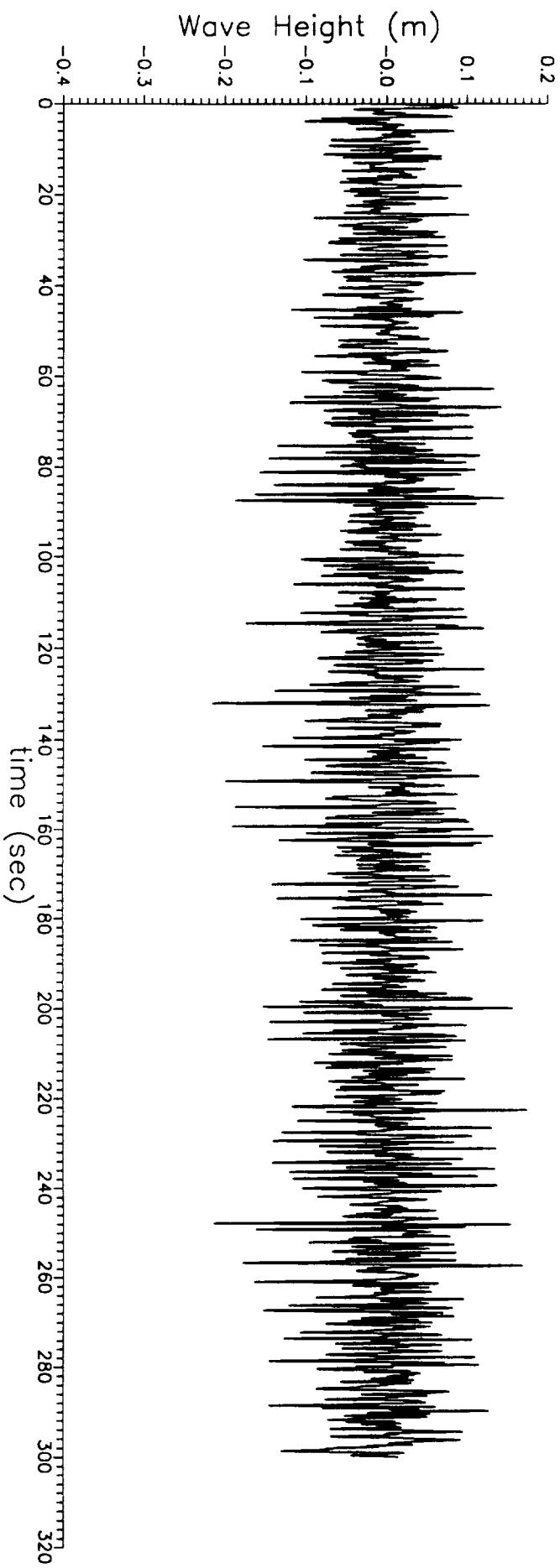
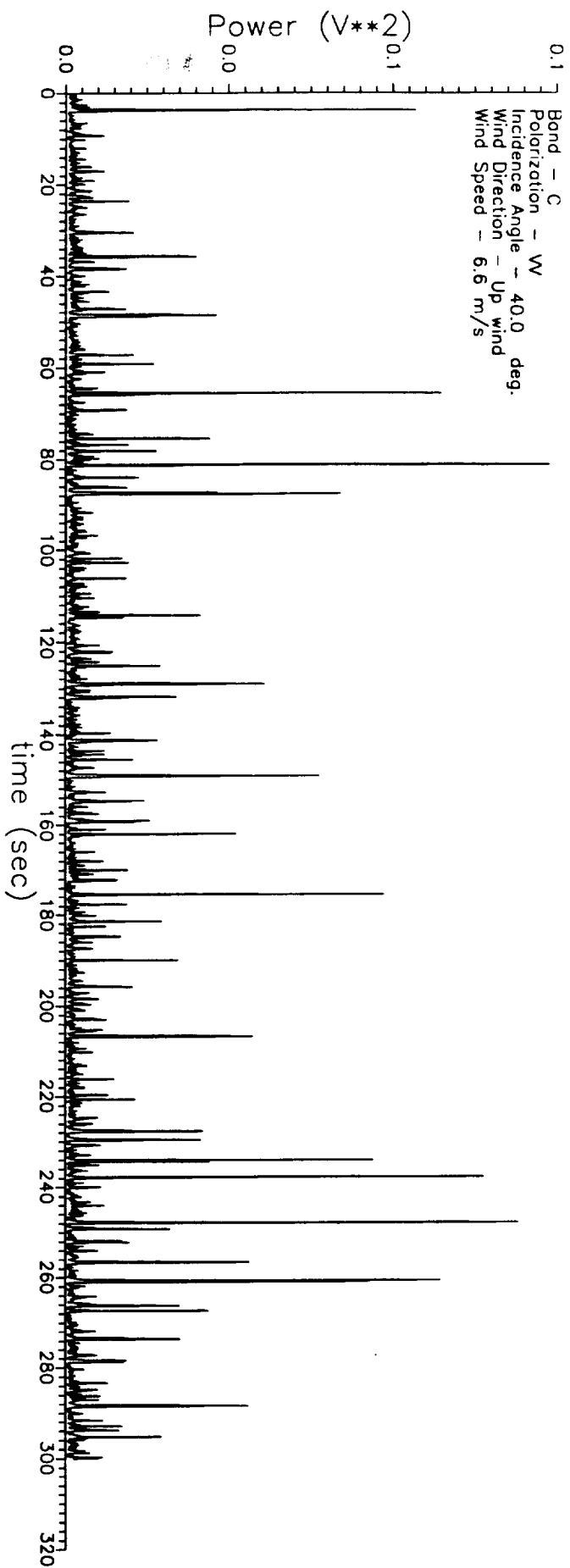


Run 17, 18:22, July 19, 1989

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.7 m/s

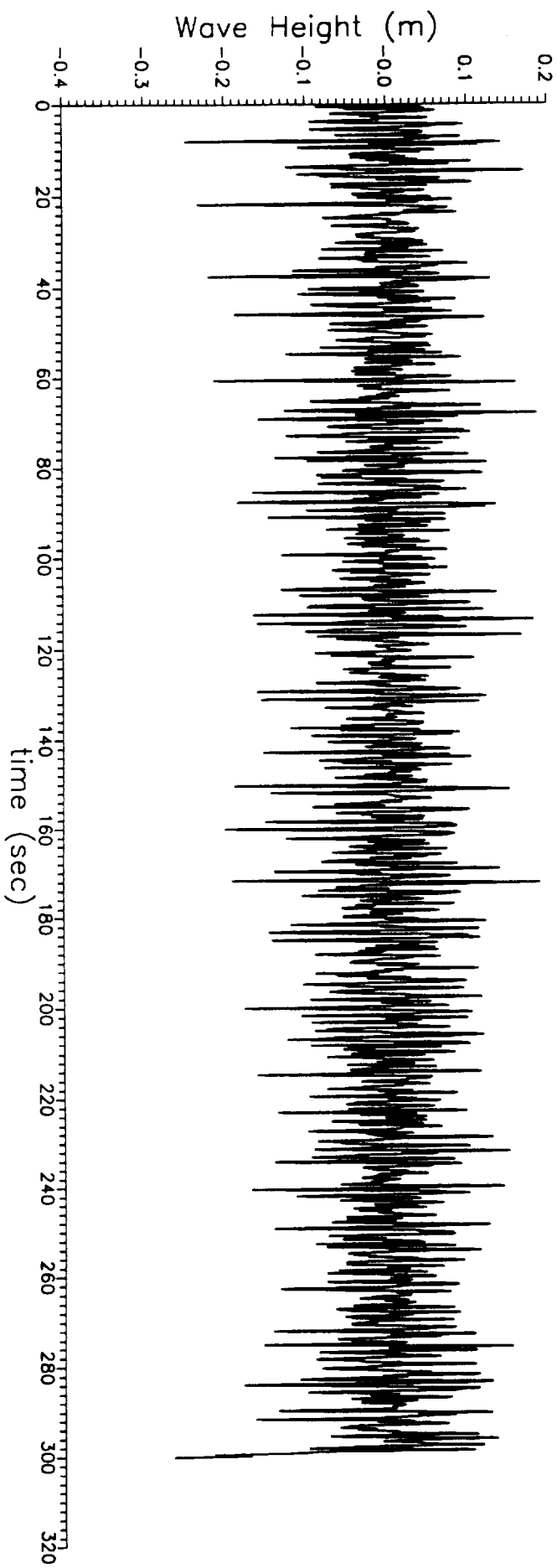
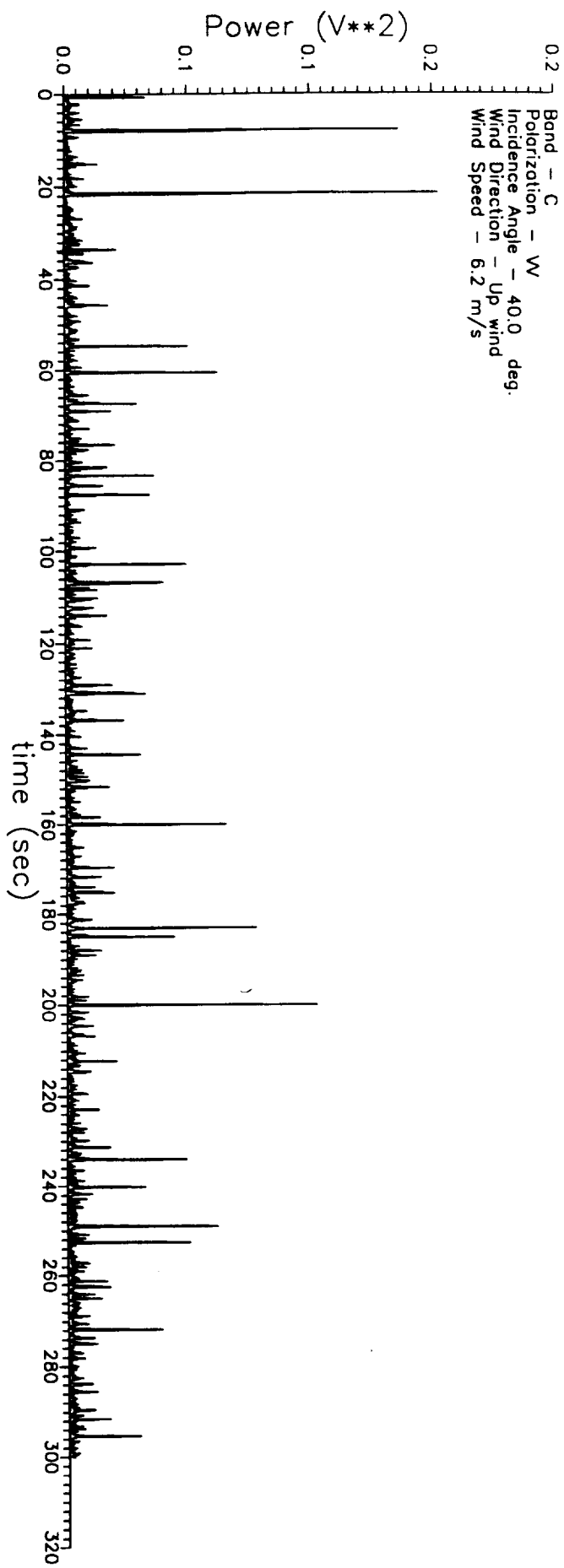


Run 18, 18:28, July 19, 1989



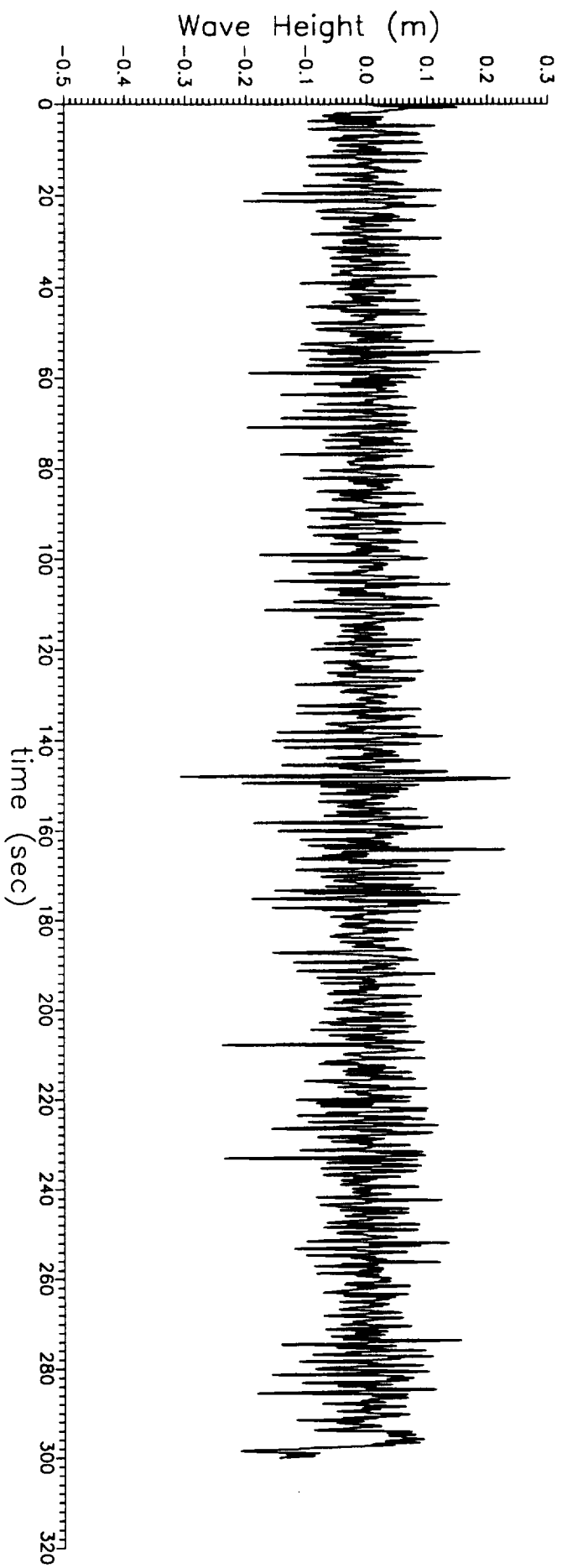
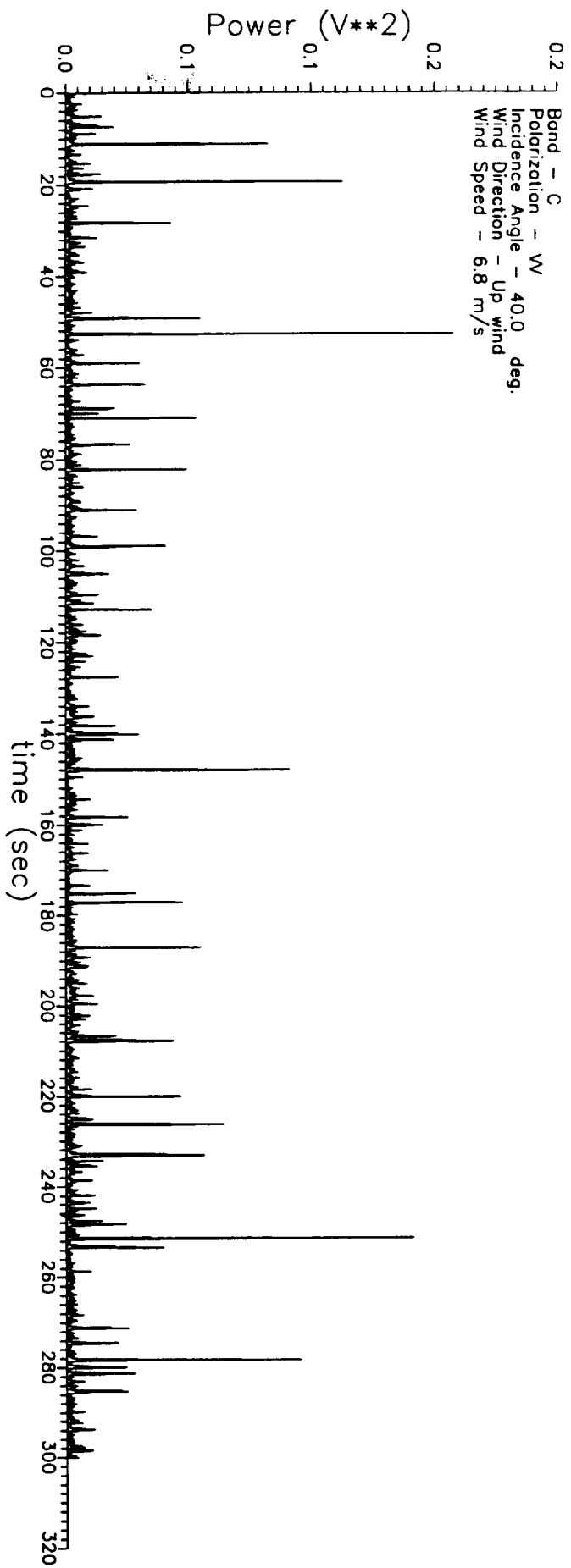
Run 19, 18:33, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.2 m/s

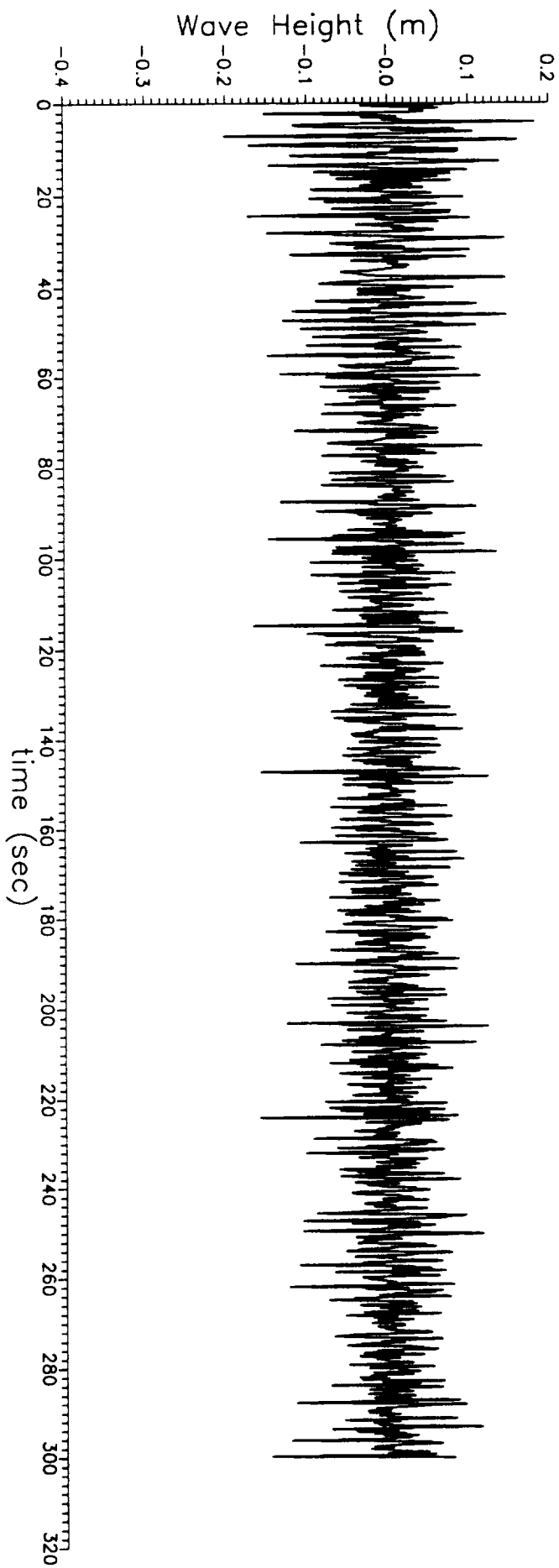
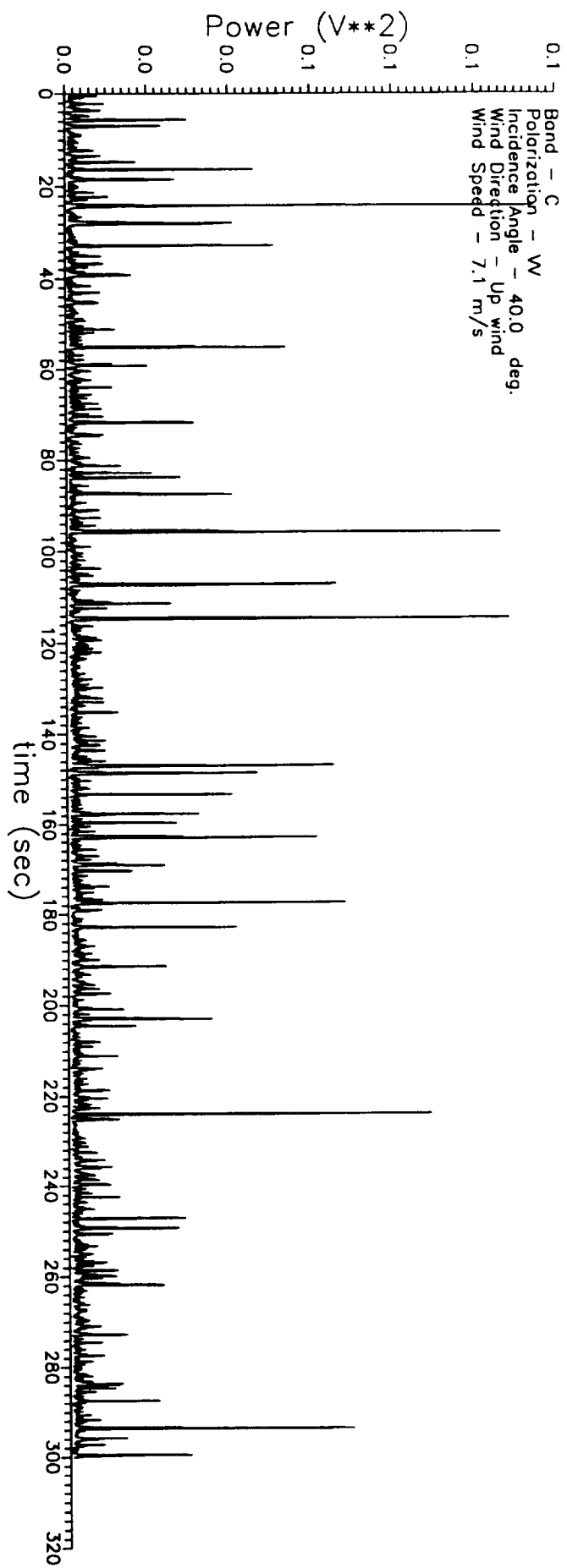


Run 20, 18:38, July 19, 1989

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.8 m/s

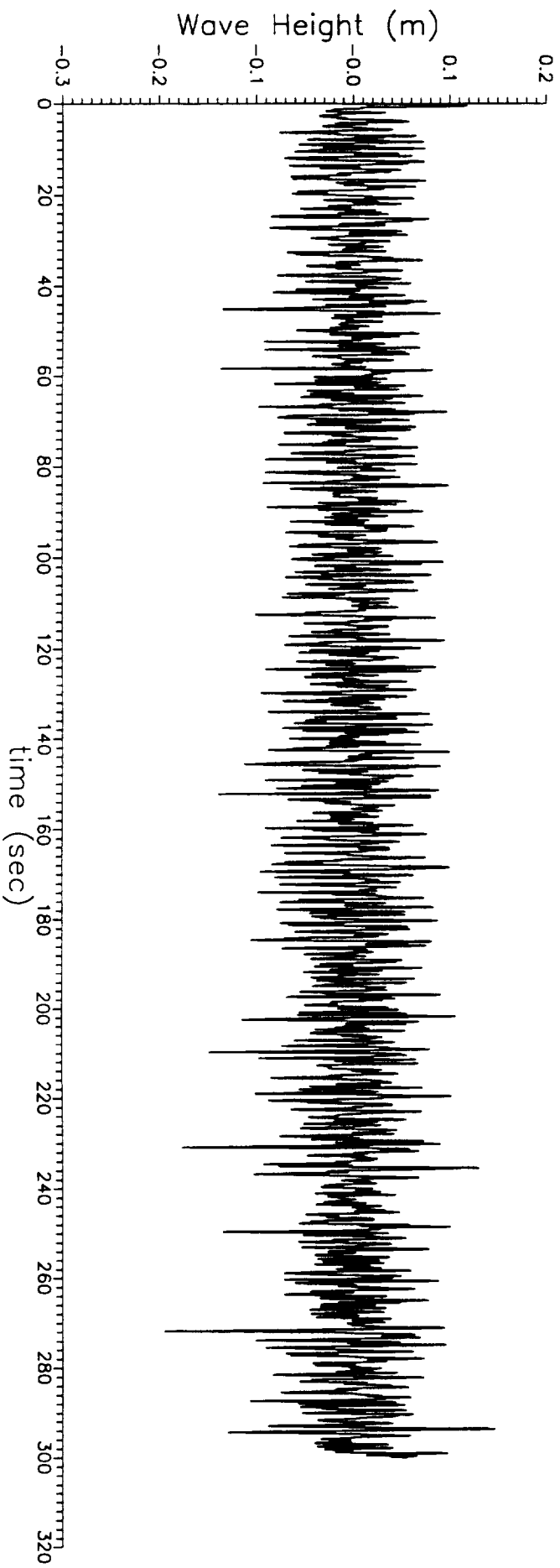
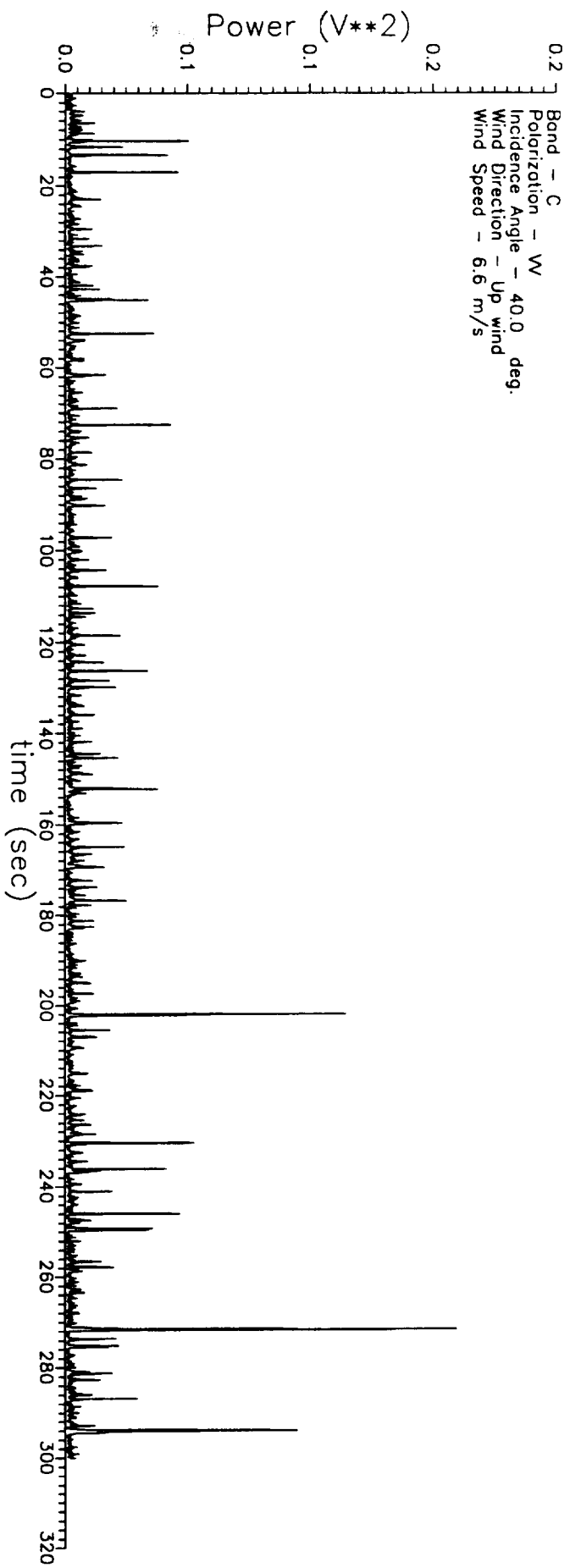


Run 21, 18:44, July 19, 1989



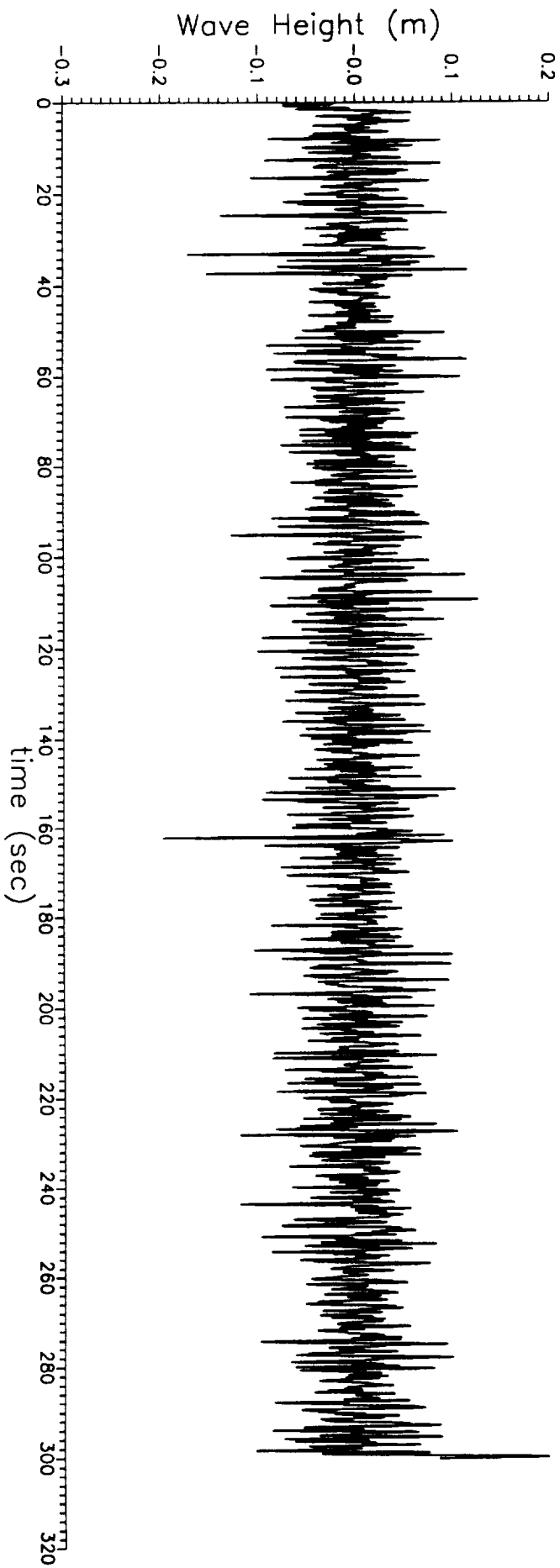
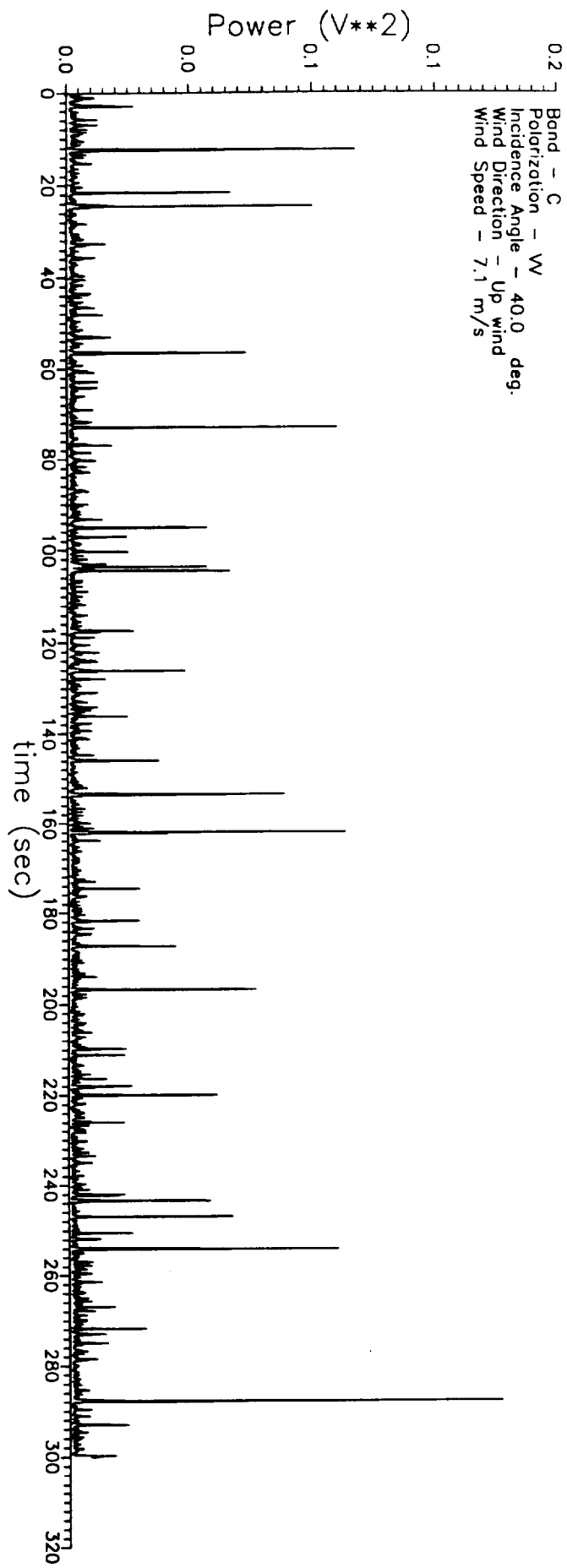
Run 22, 18:49, July 19, 1989

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



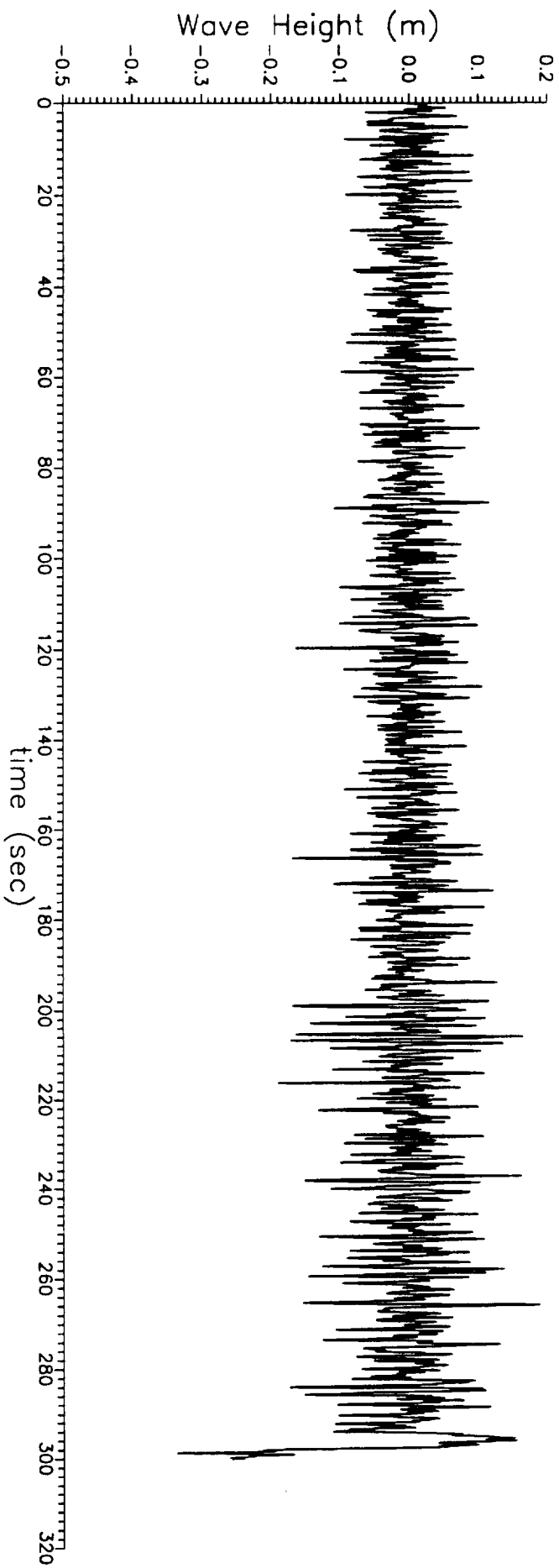
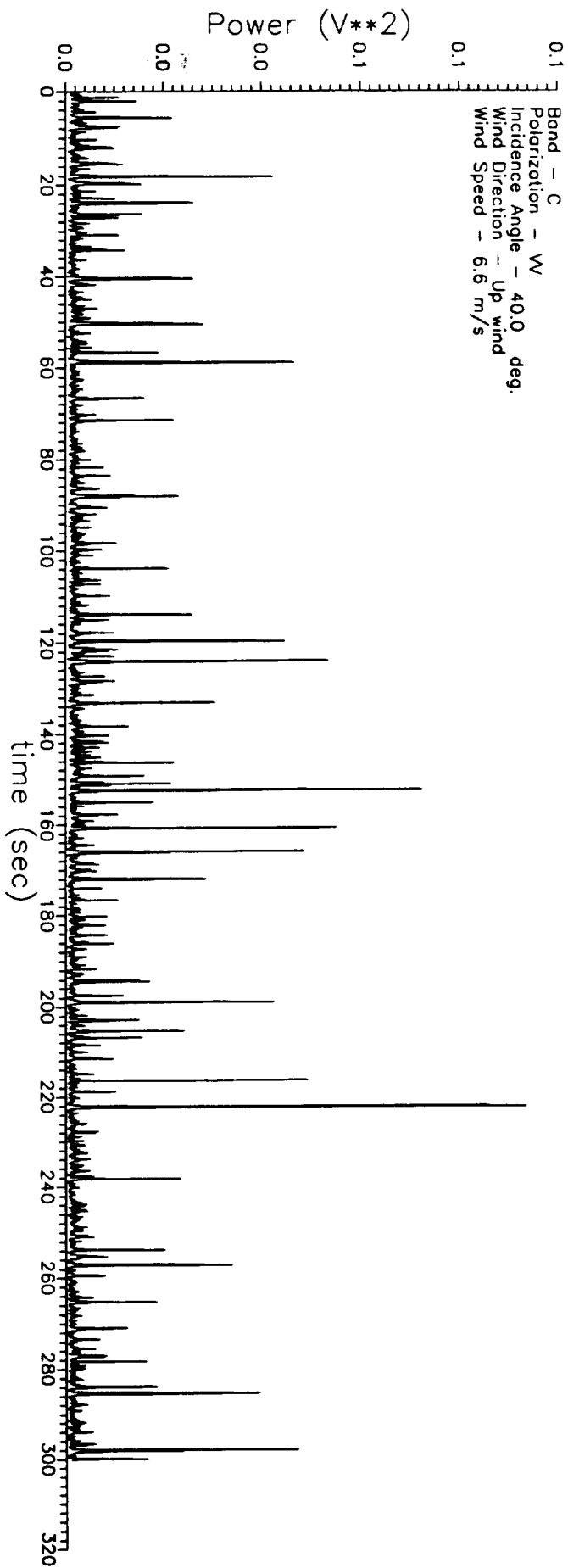
Run 23, 18:55, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.1 m/s



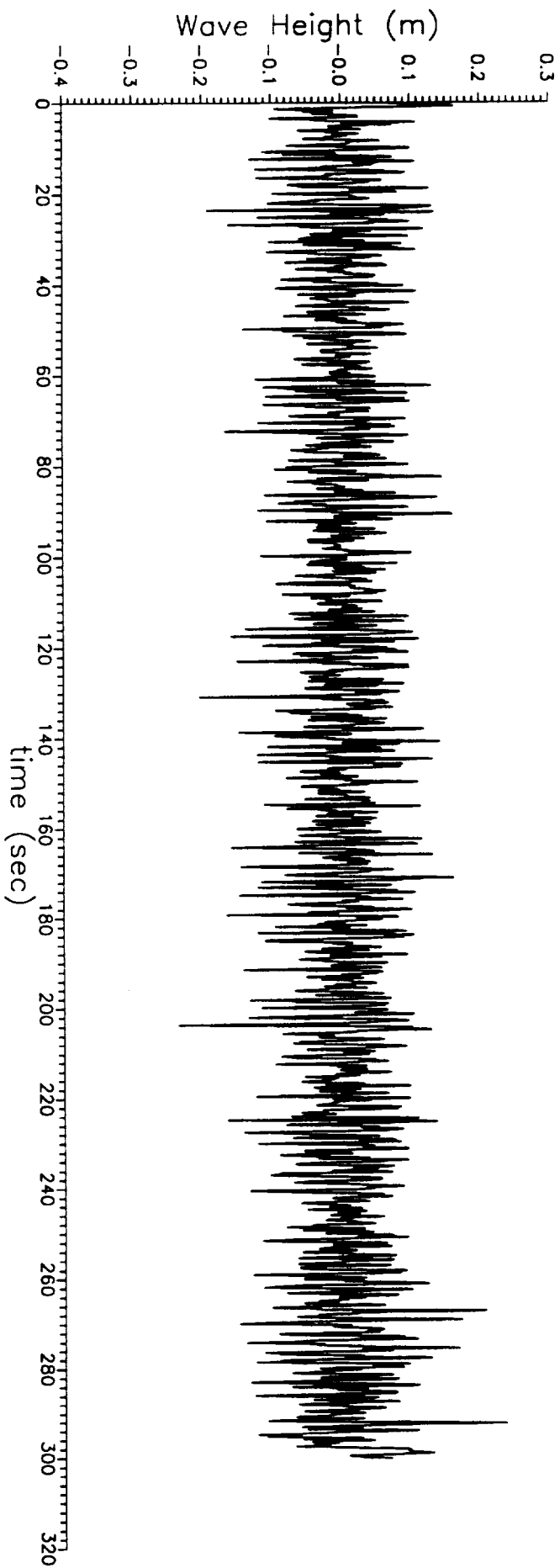
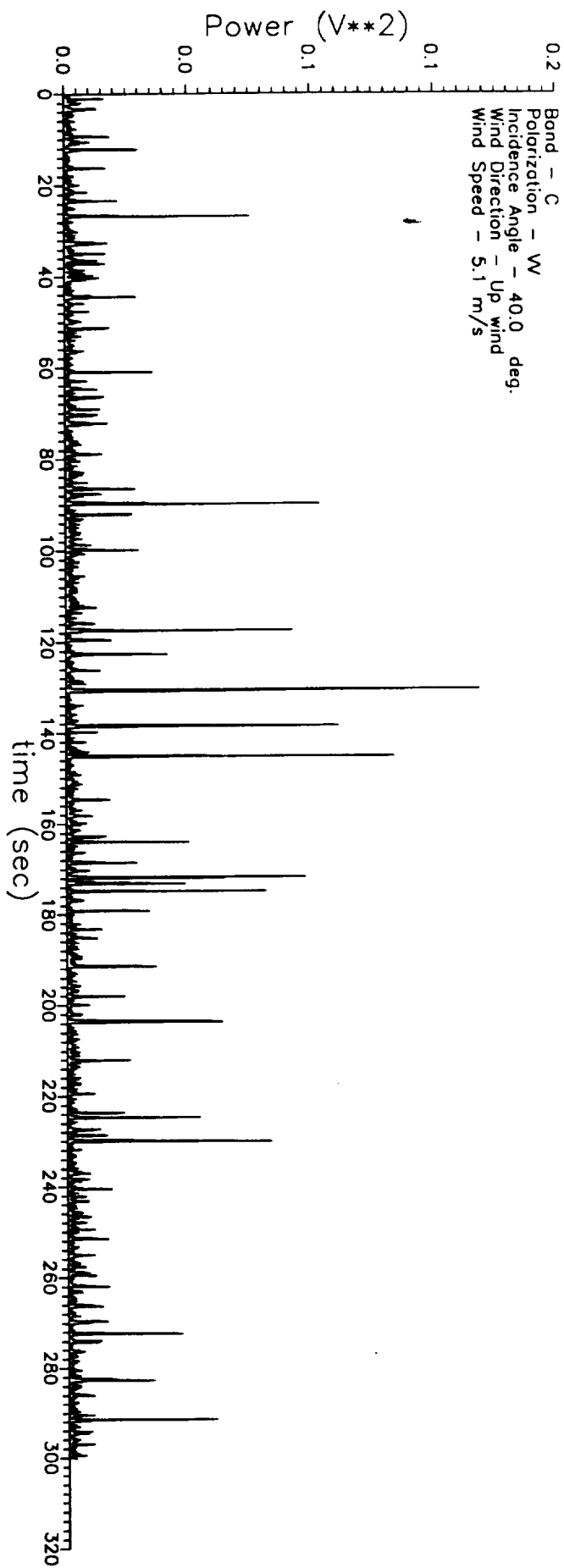
Run 24, 19:00, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



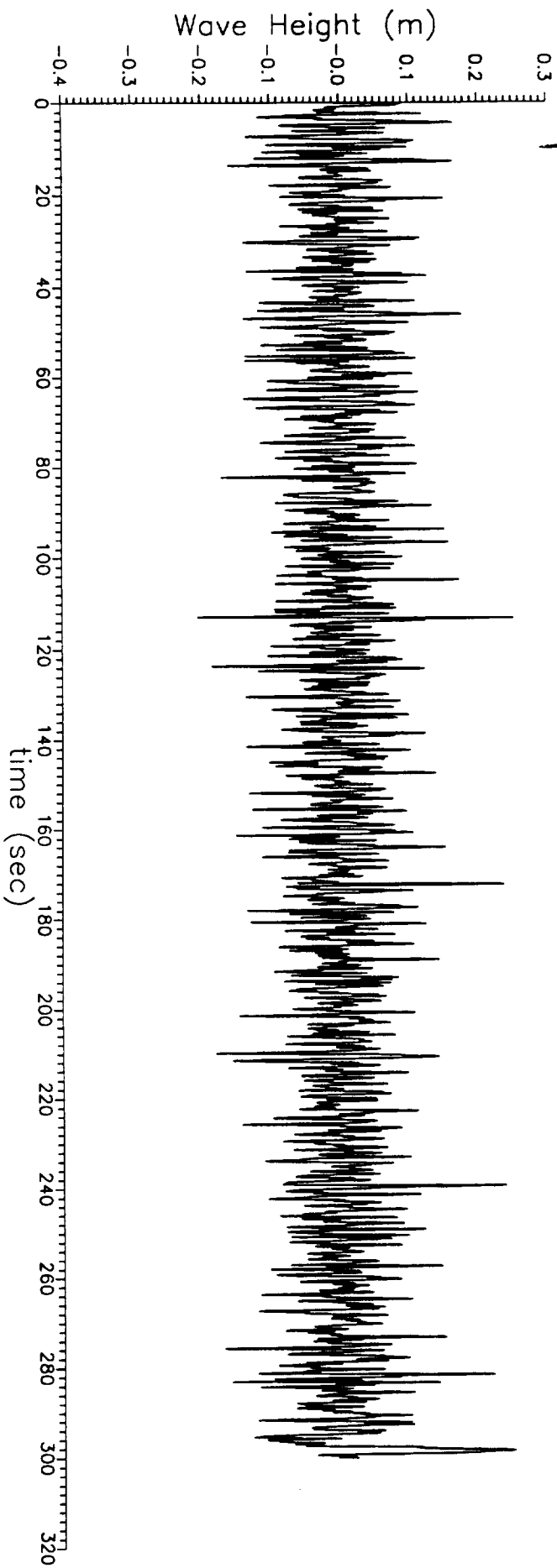
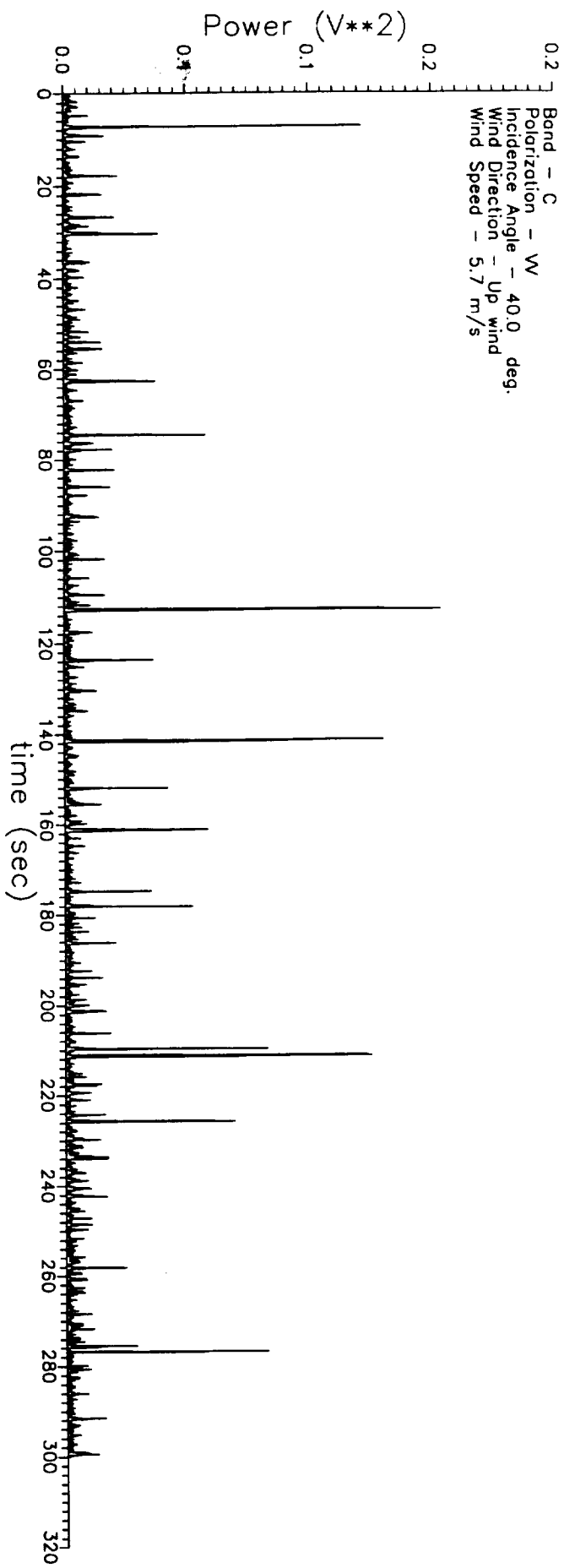
Run 25, 19:15, July 19, 1989

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.1 m/s



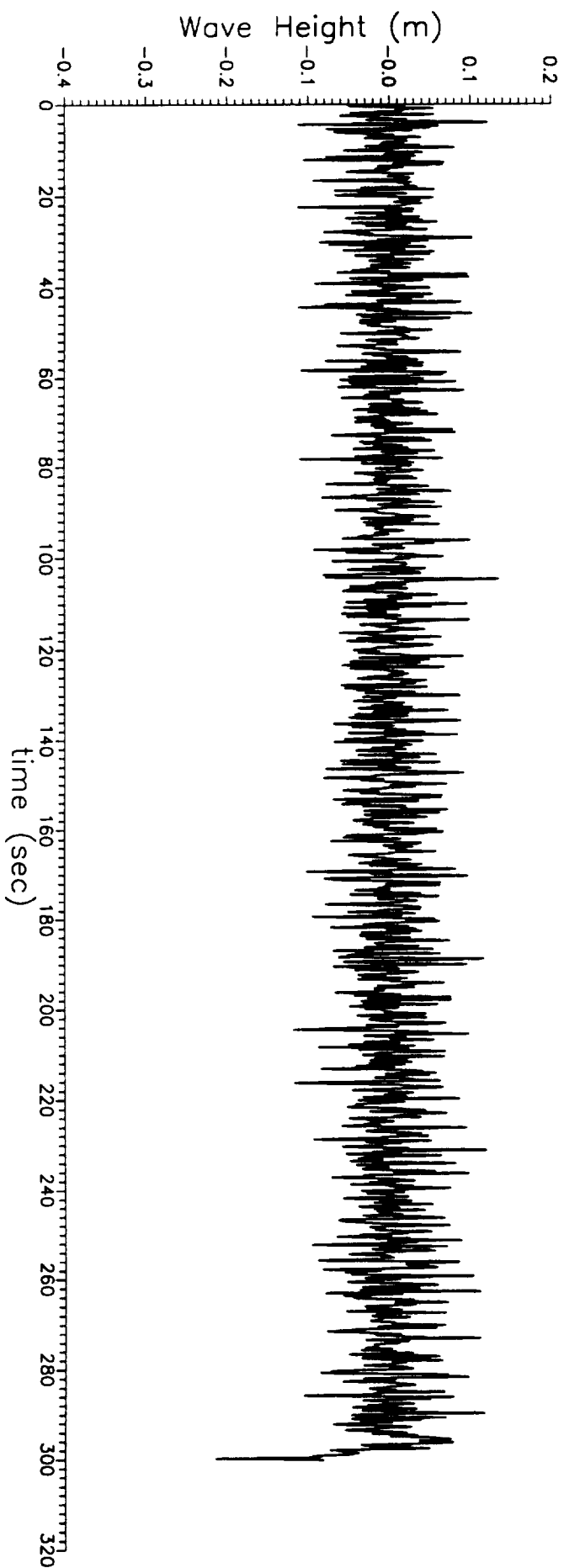
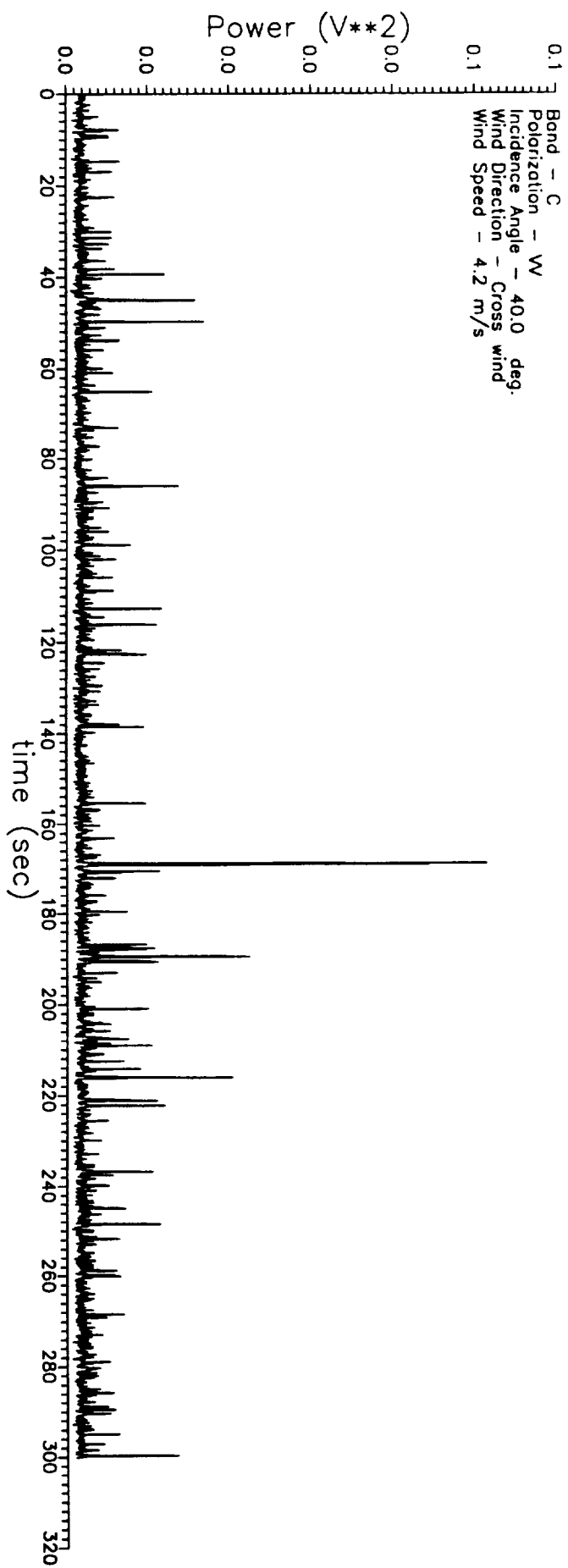
Run 26, 19:11, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.7 m/s



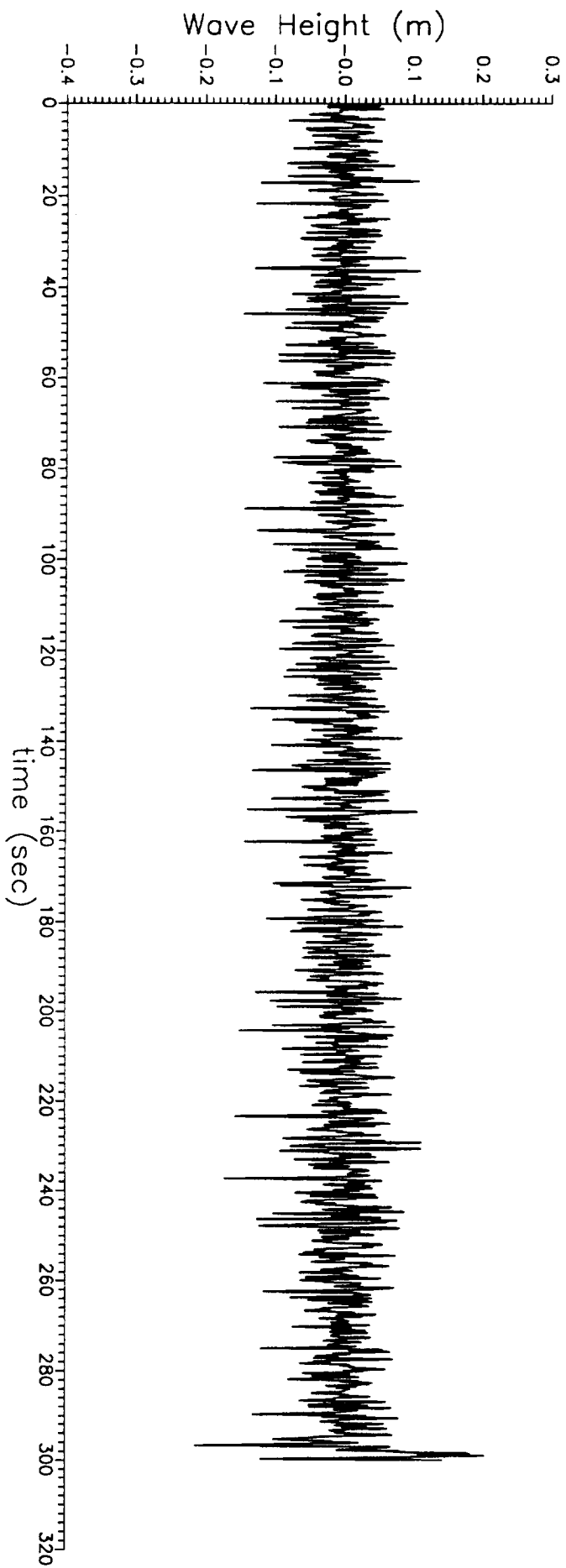
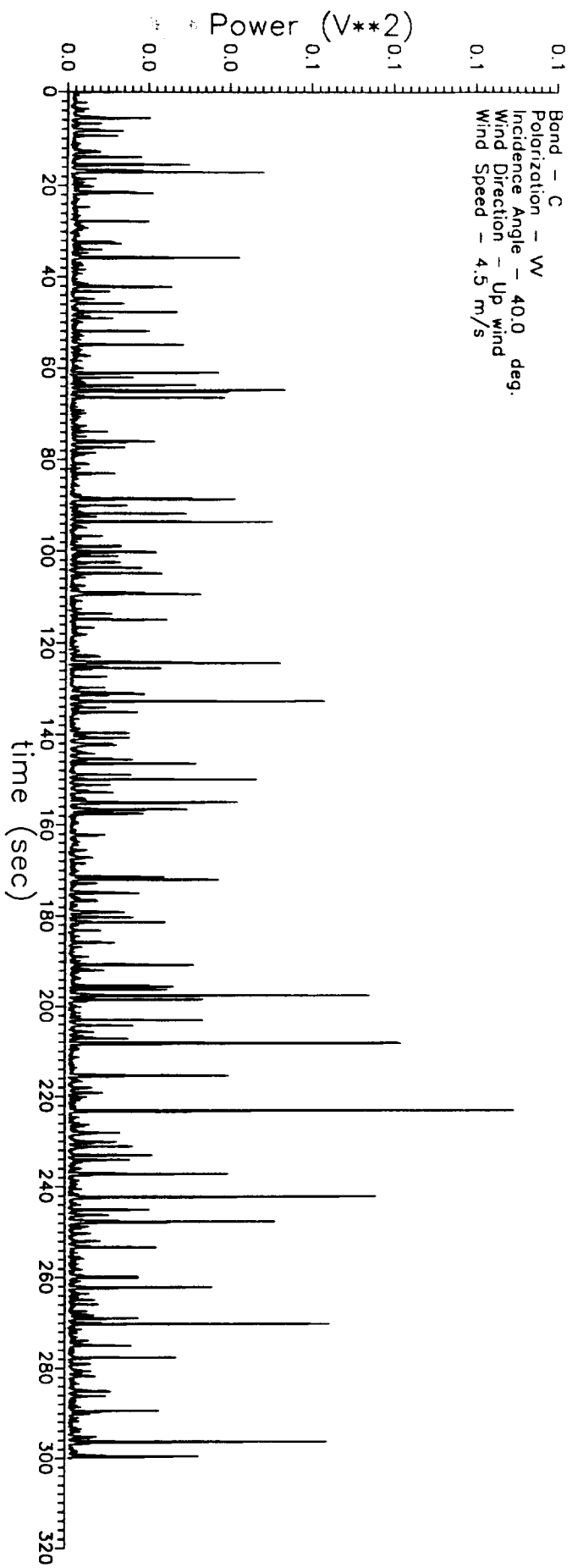
Run 36, 20:23, July 19, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.2 m/s

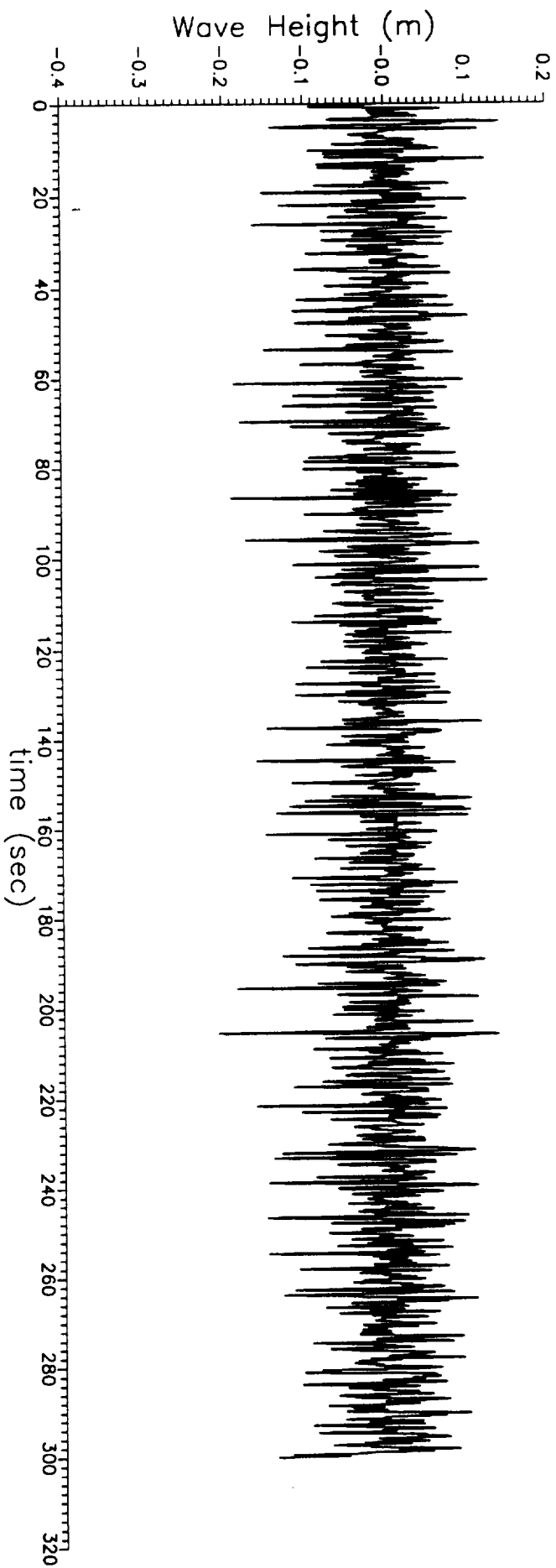
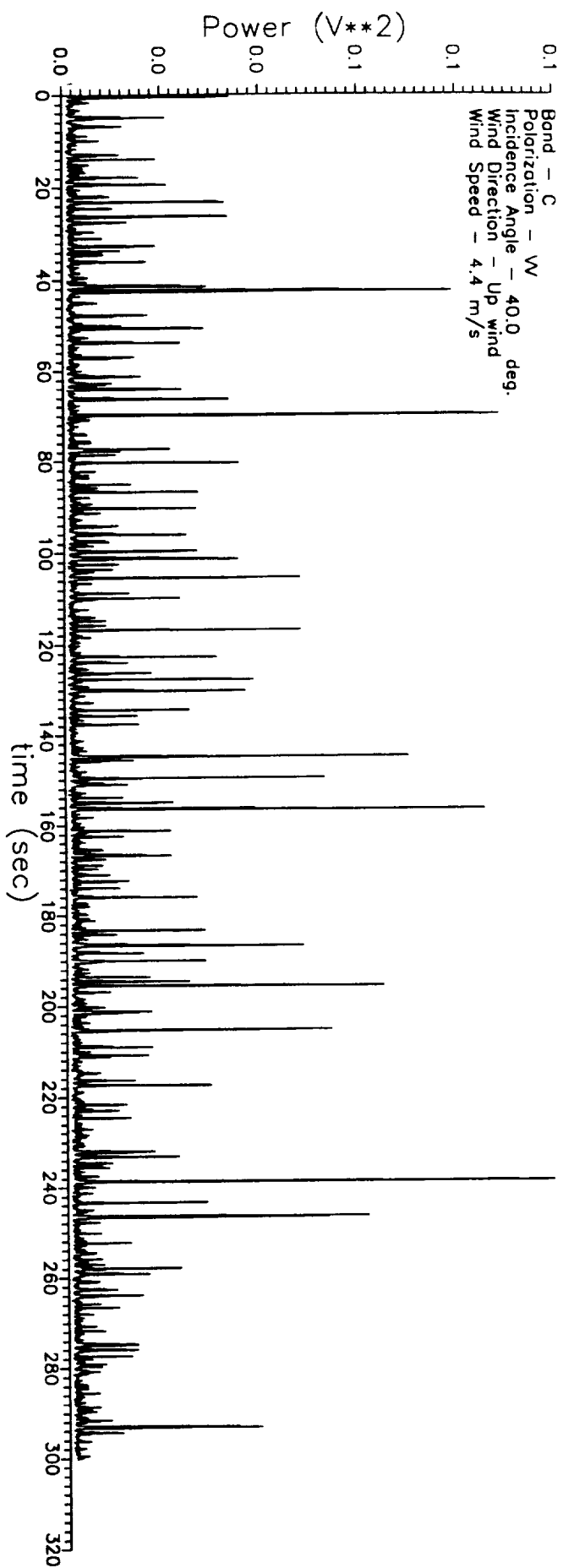


Run 9, 13:39, July 25, 1989

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.5 m/s

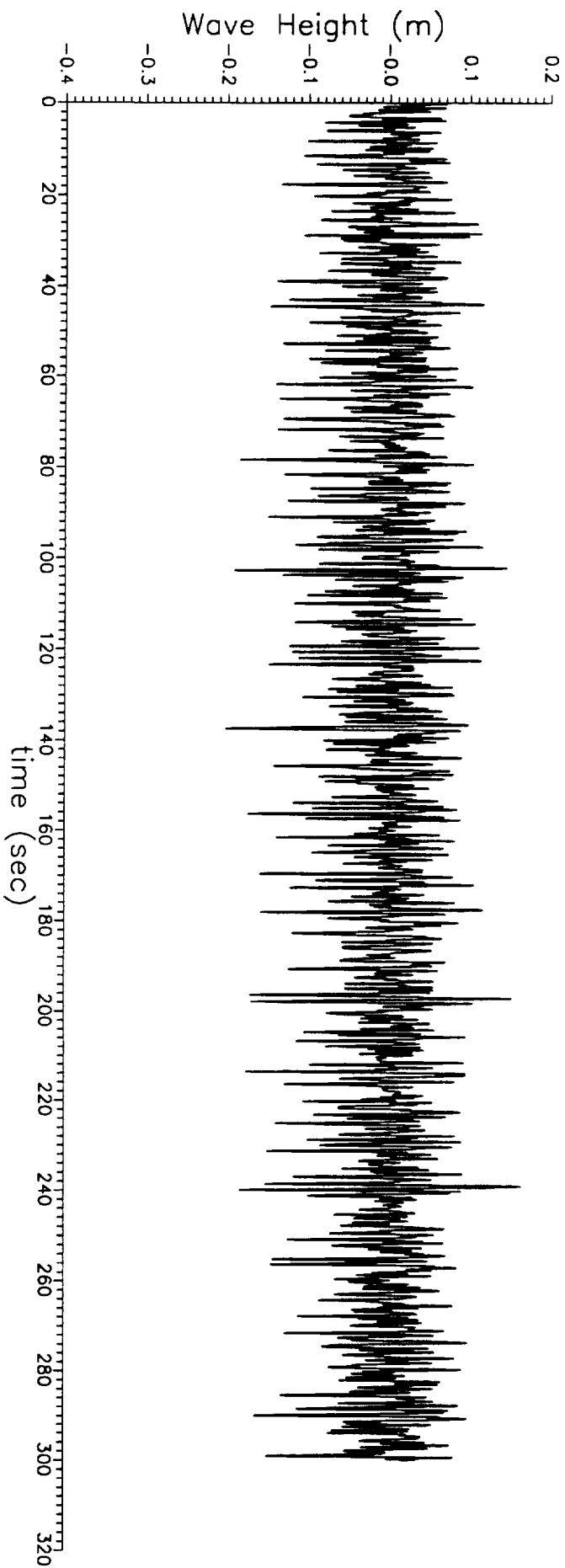
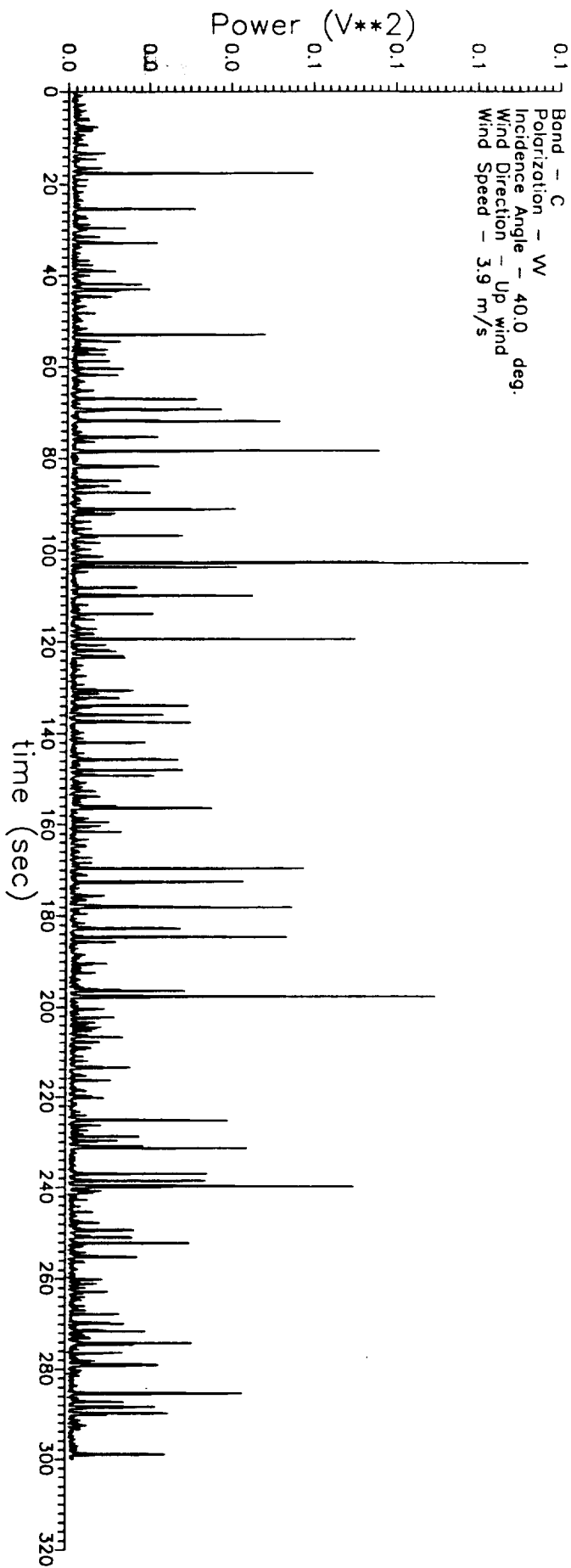


Run 12, 113:58, July 25, 198

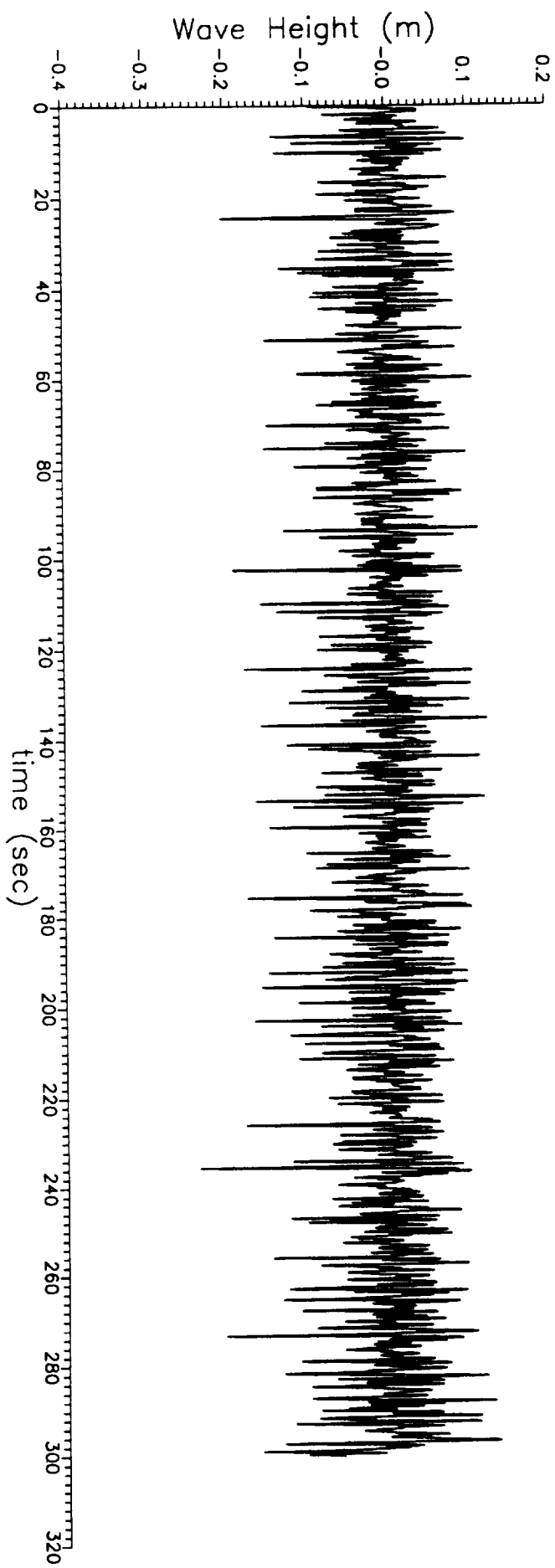
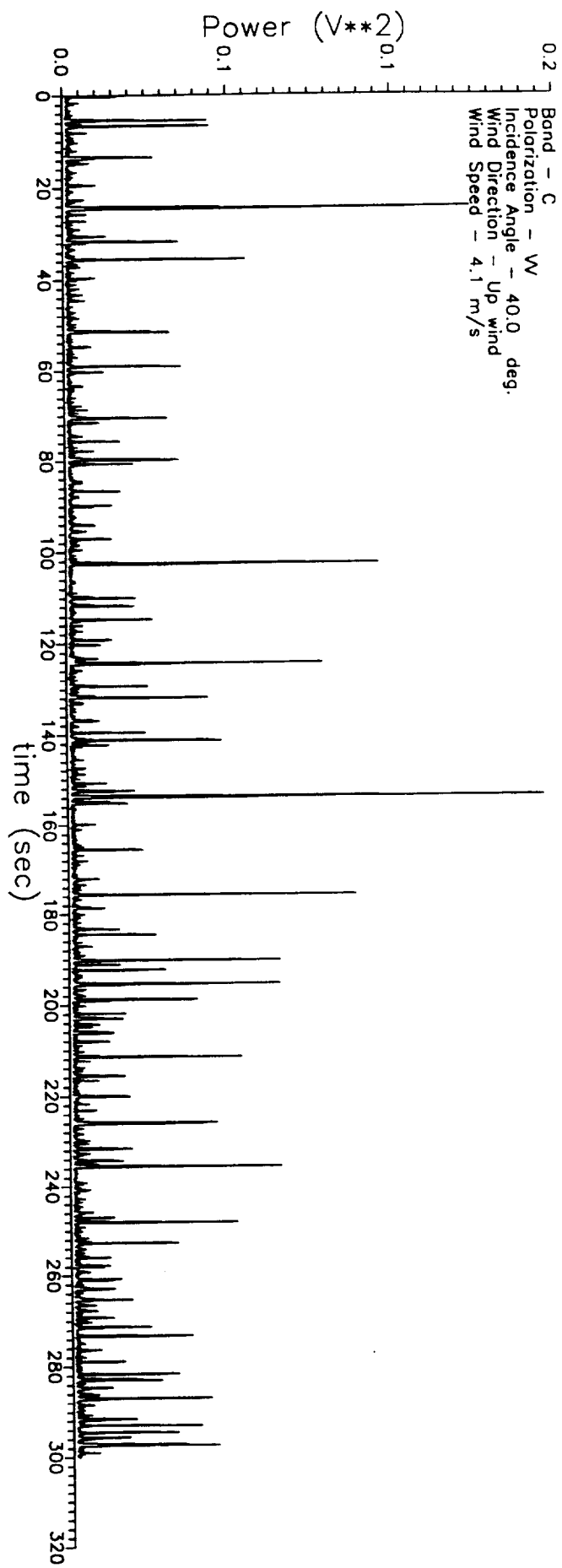


Run 13, 14:03, July 25, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s

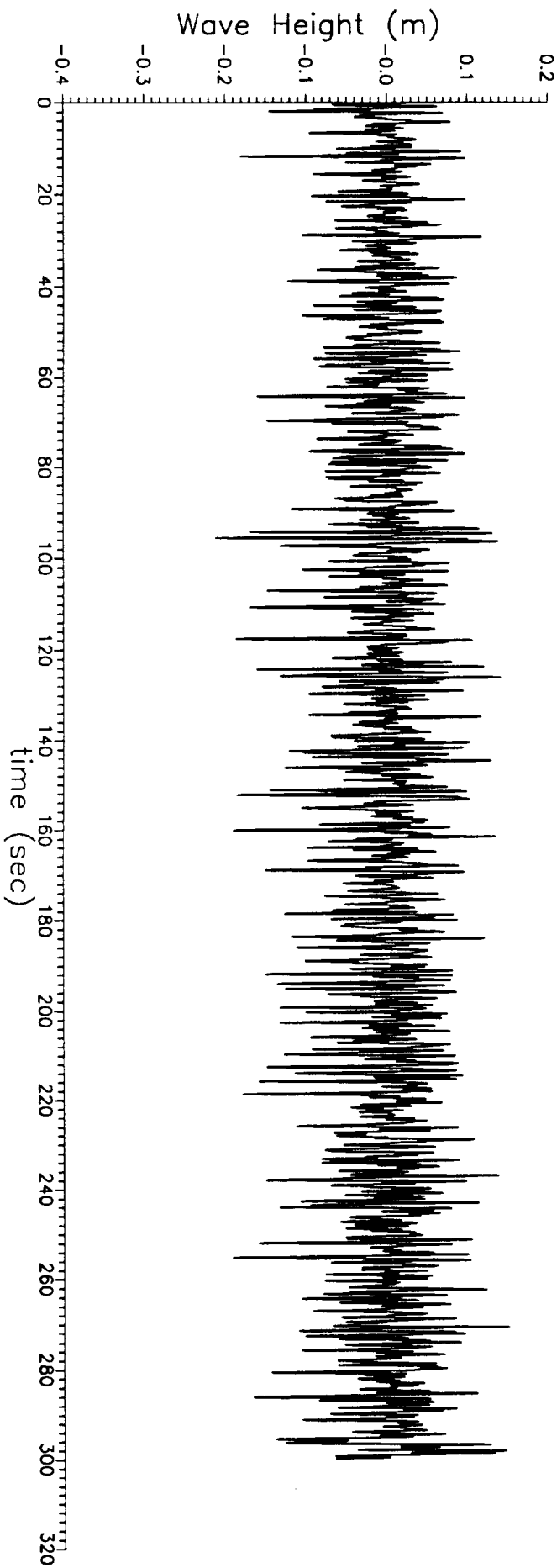
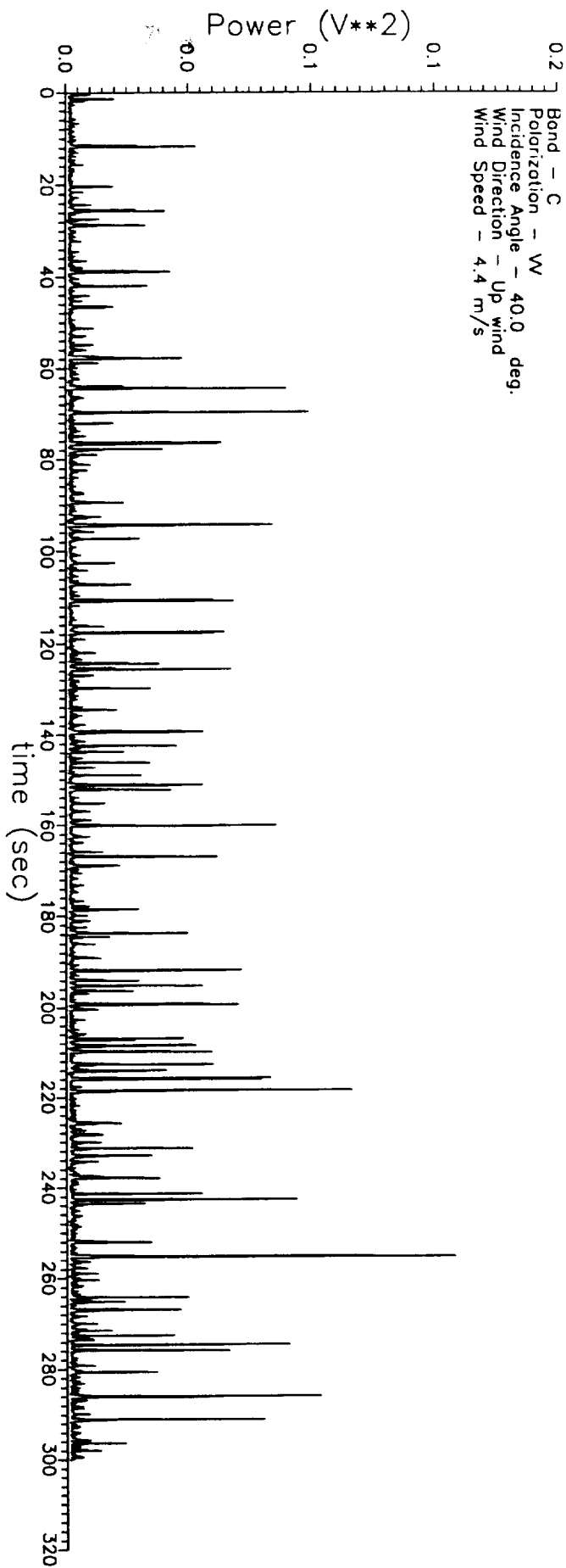


Run 14, 14:08, July 25, 1989

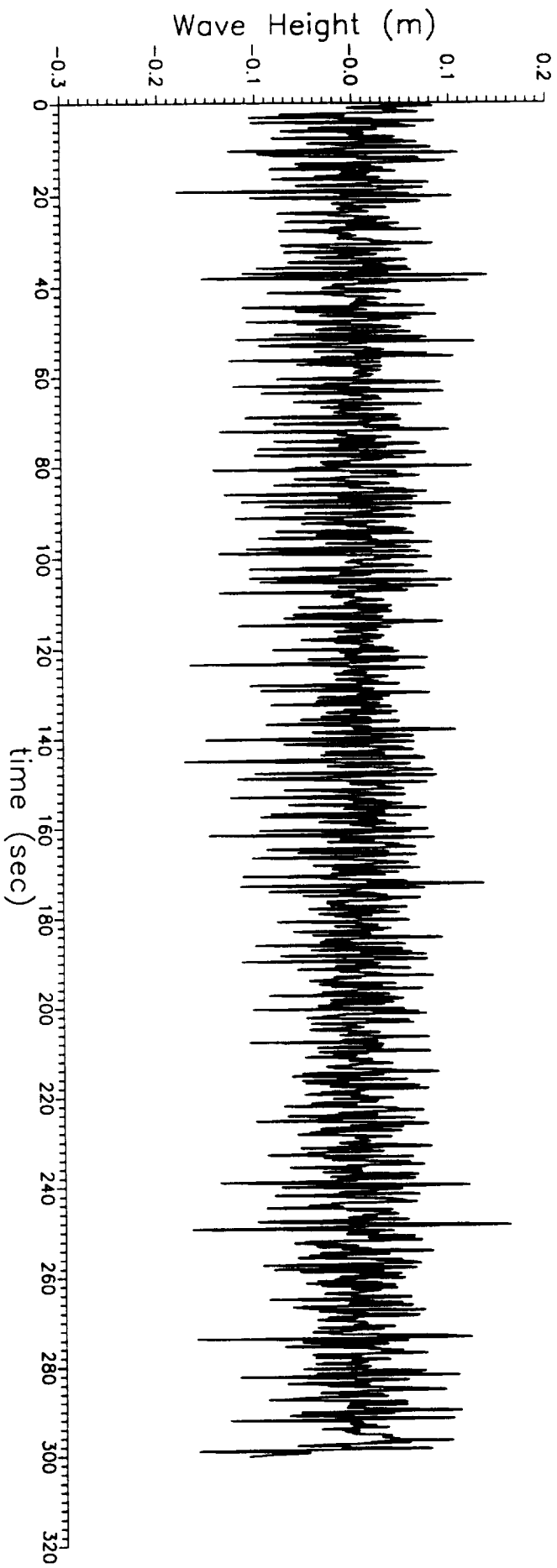
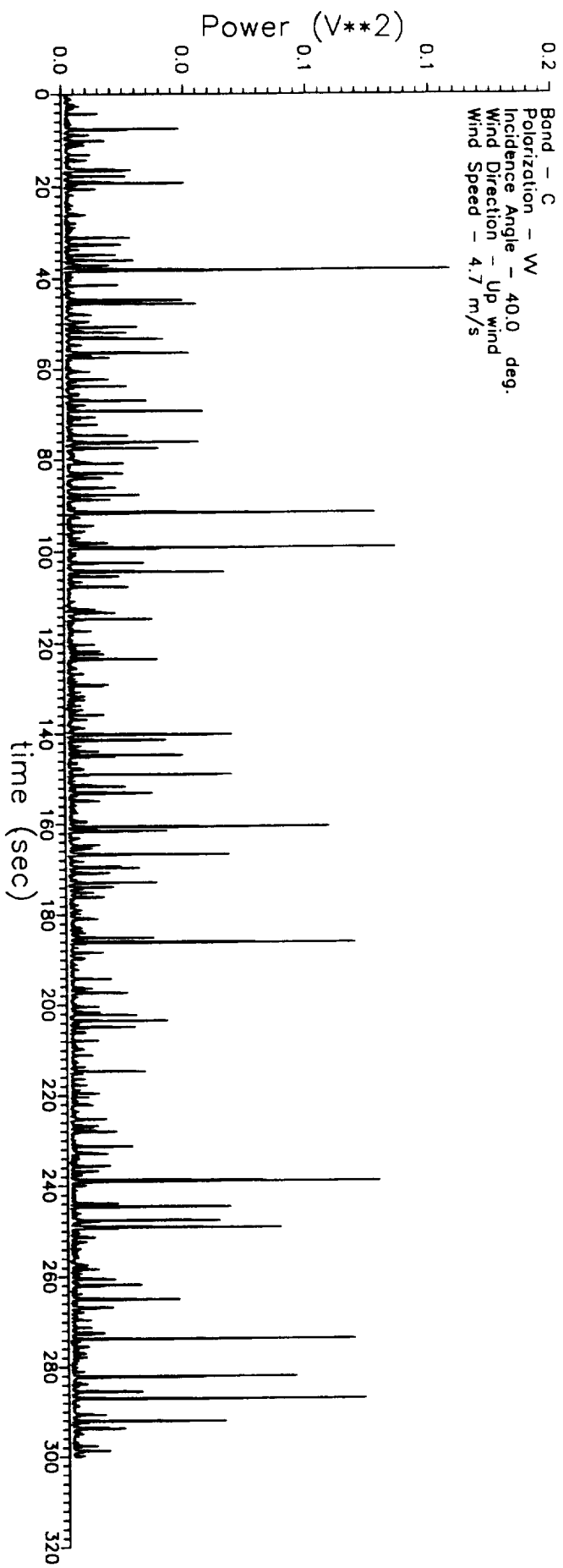


Run 15, 14:14, July 25, 1989

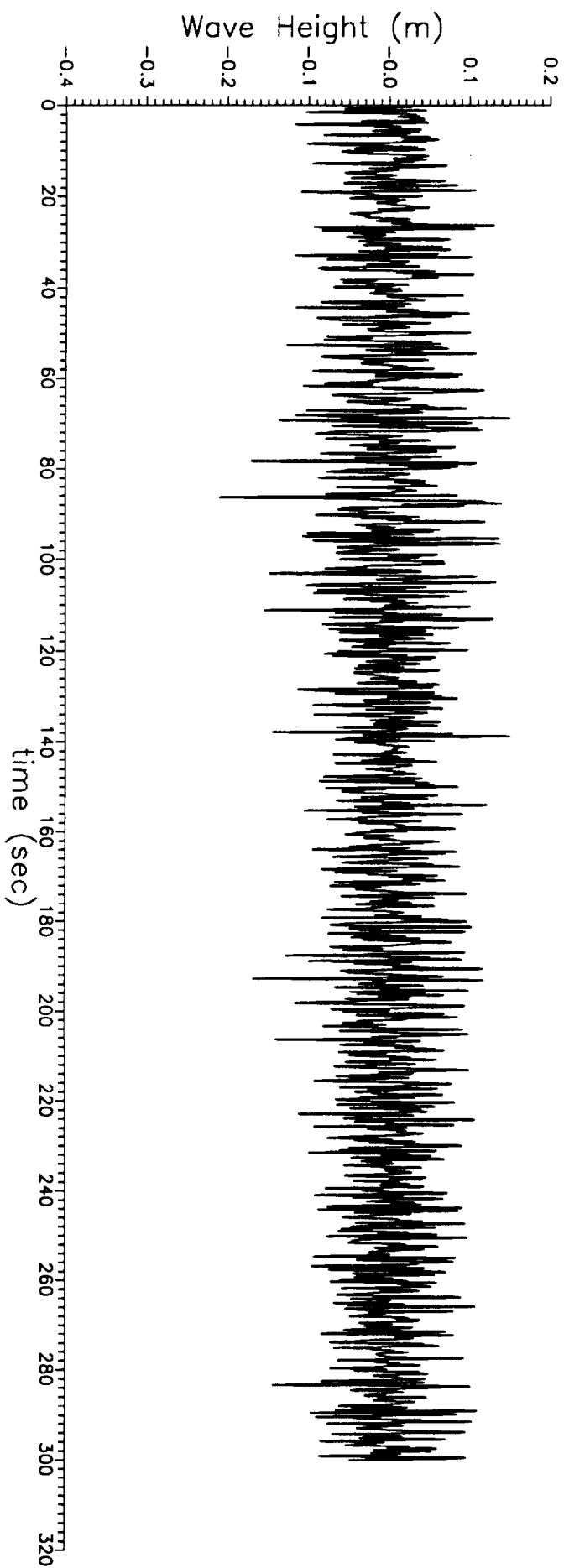
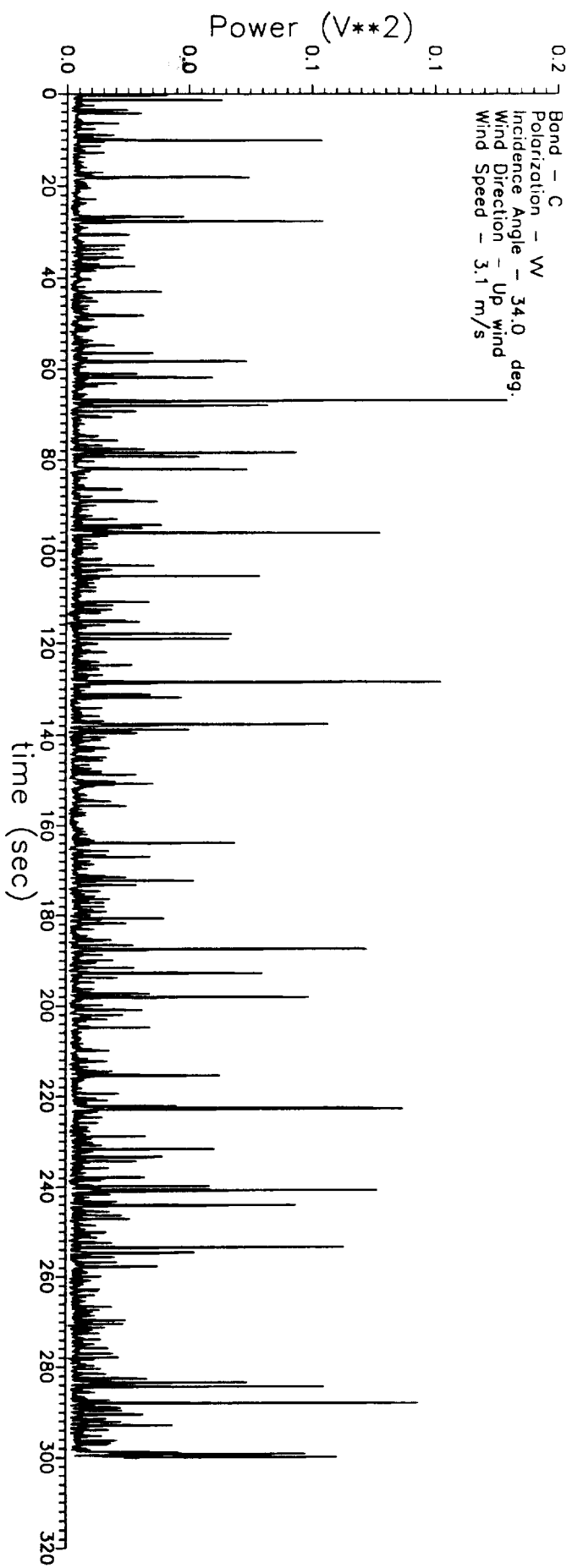
Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s



Run 16, 14:19, July 25, 1989

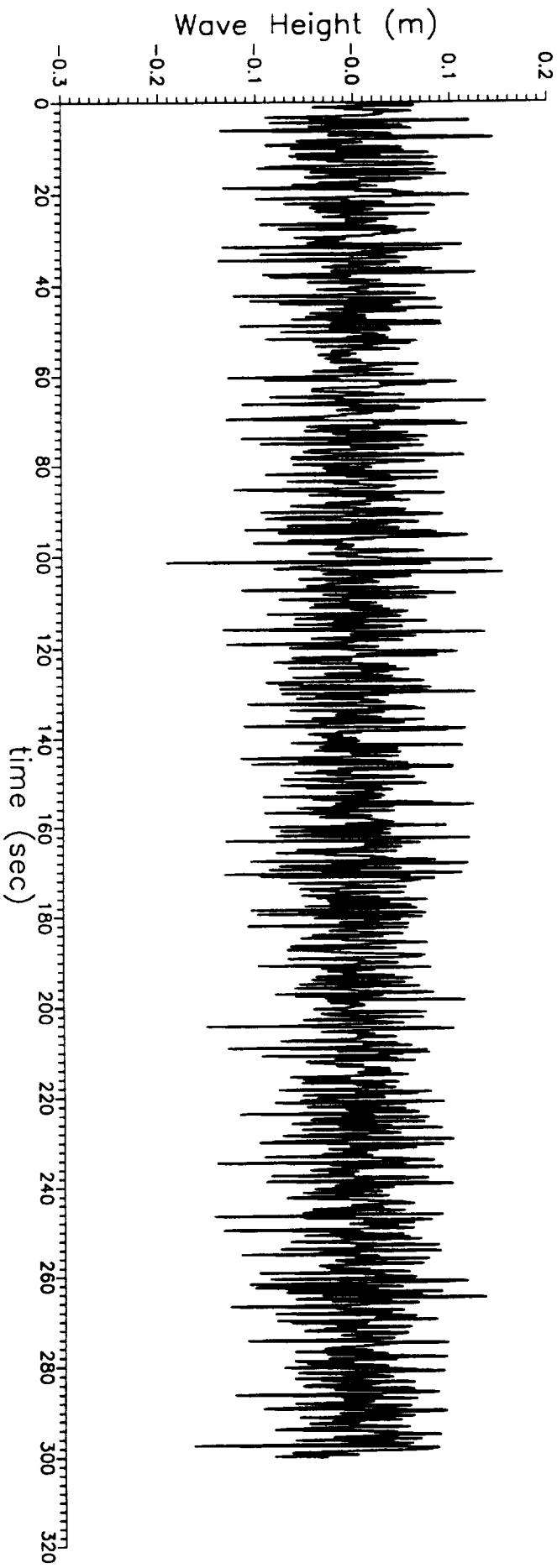
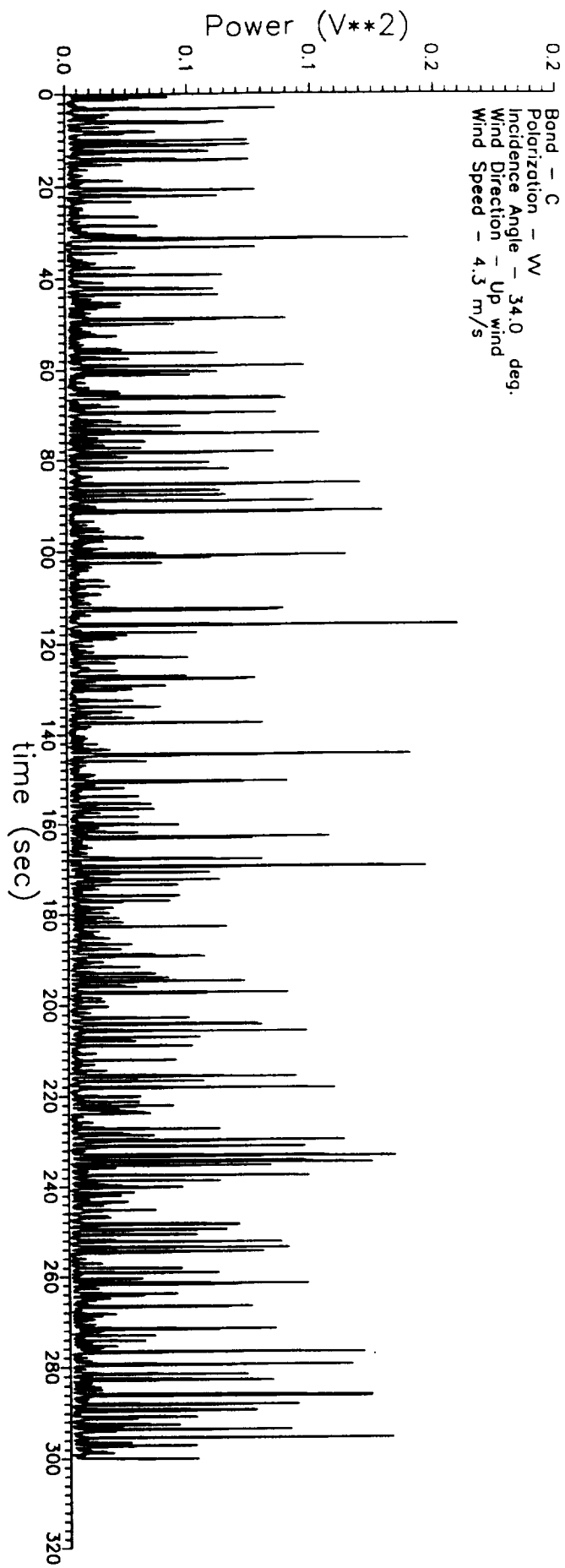


Run 1, 16:46, Aug 3, 1989



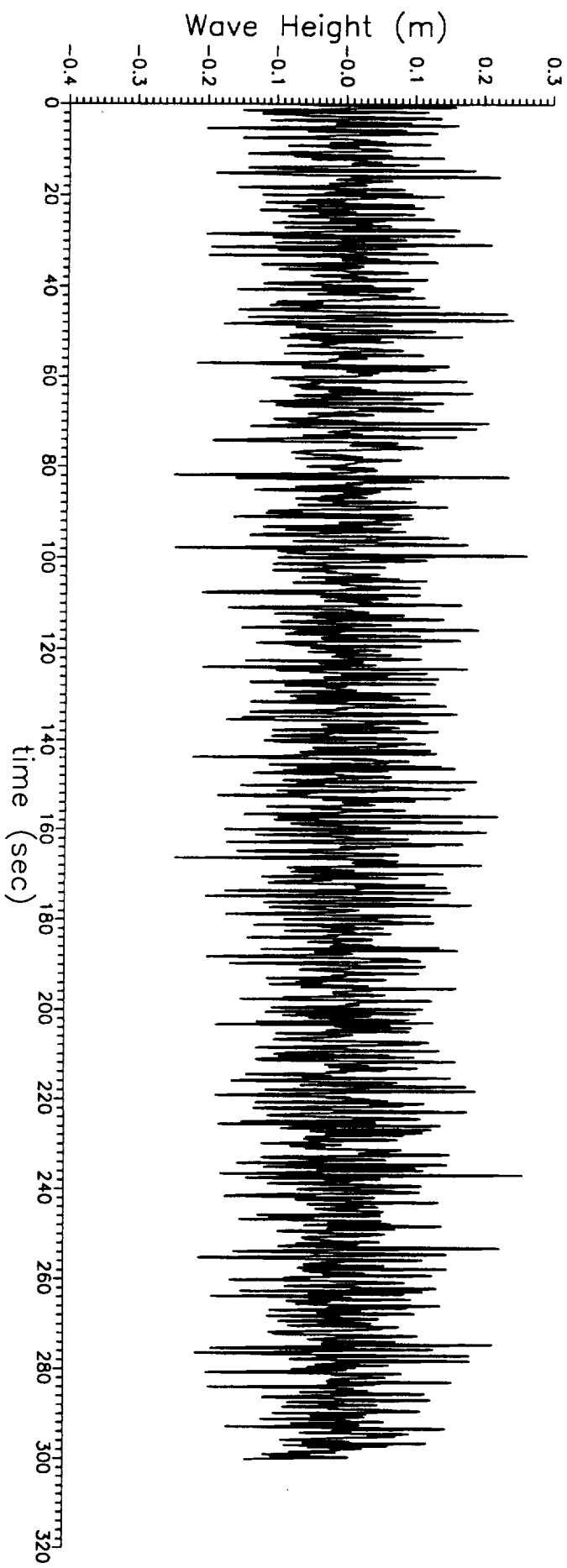
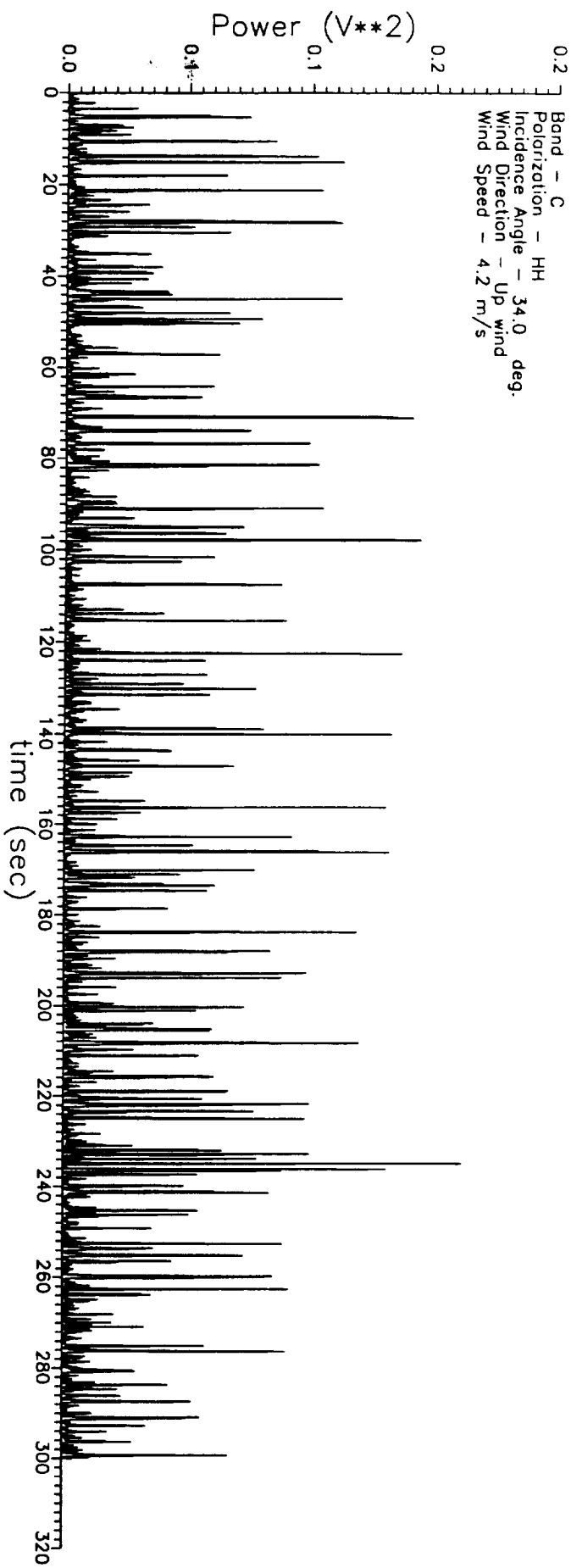
Run 7, 18:14, Aug 3, 1989

Bond - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.3 m/s

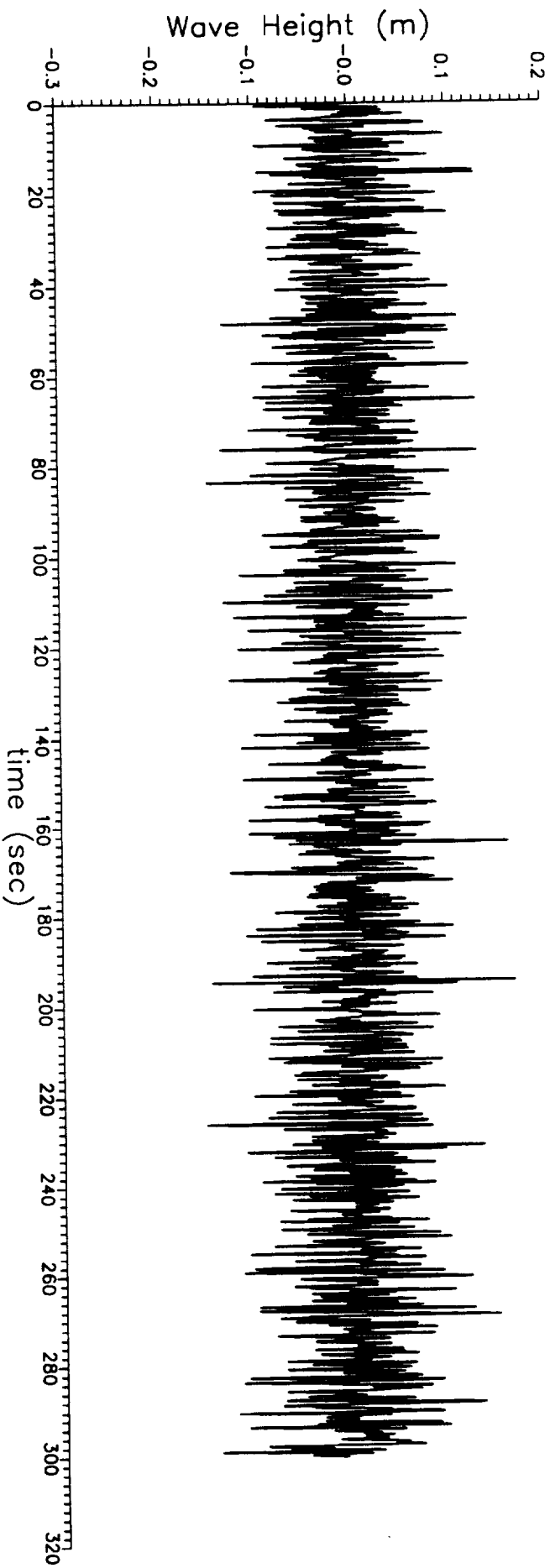
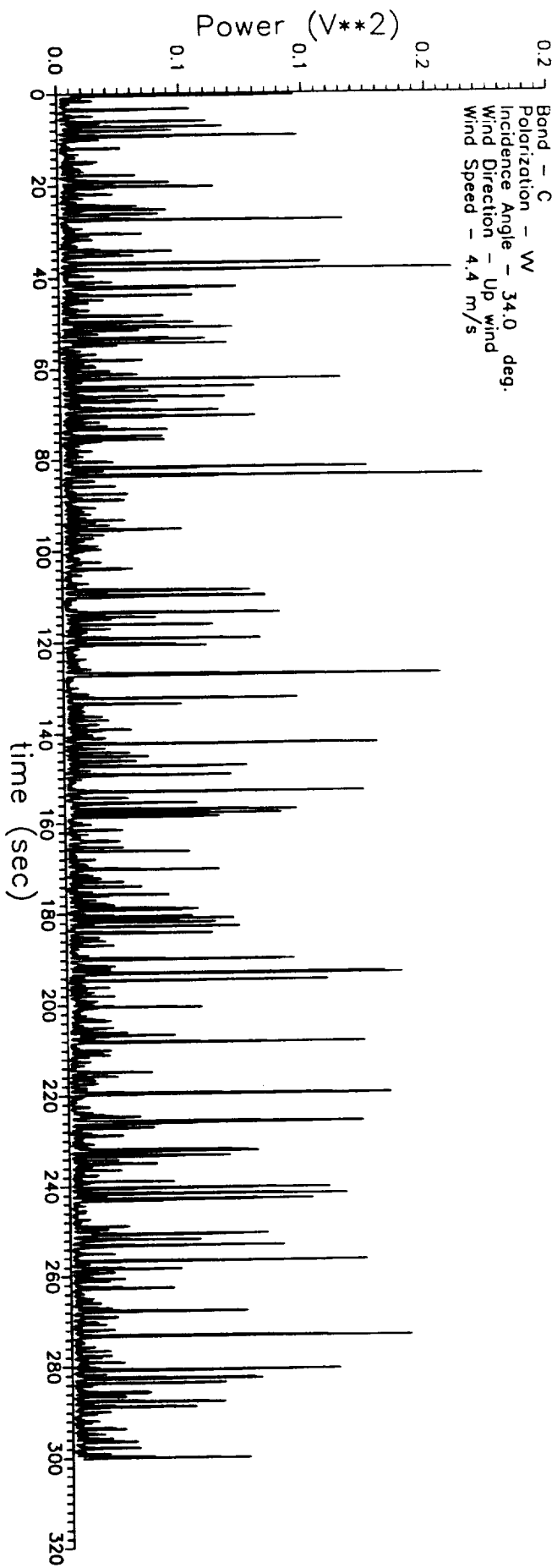


Run 8, 18:24, Aug 3, 1989

Band - C
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s

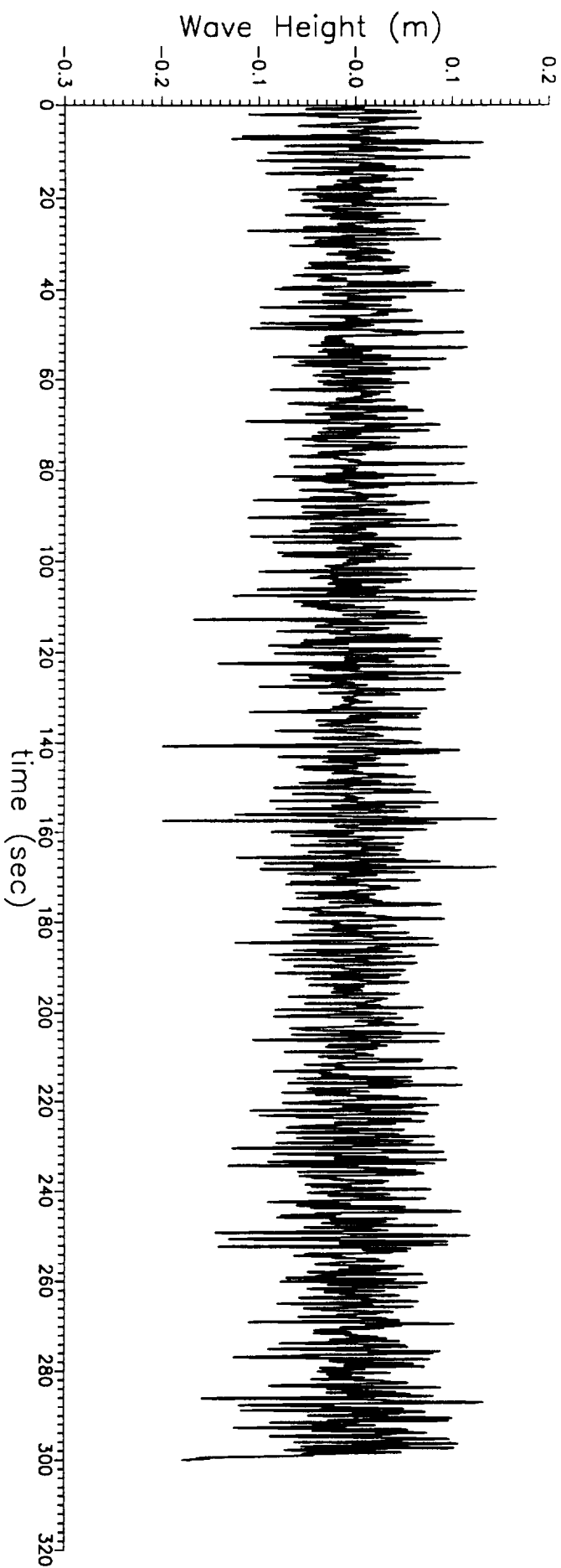
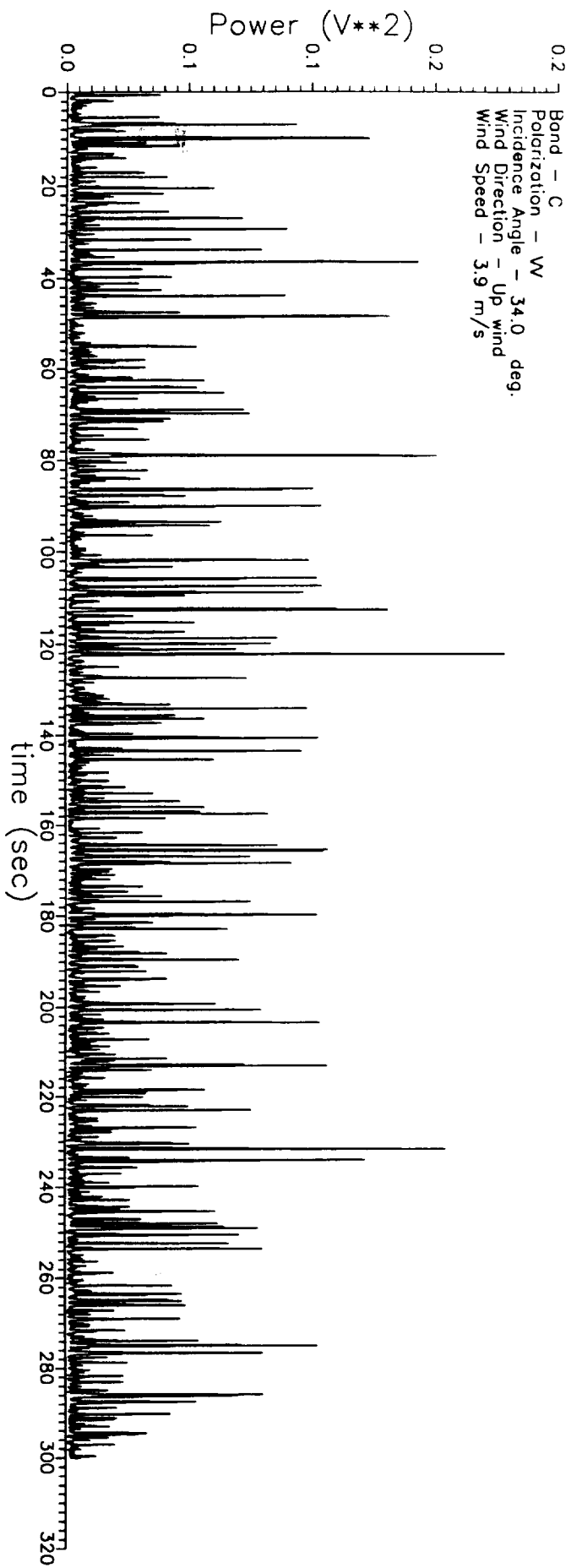


Run 9, 18:31, Aug 3, 1989



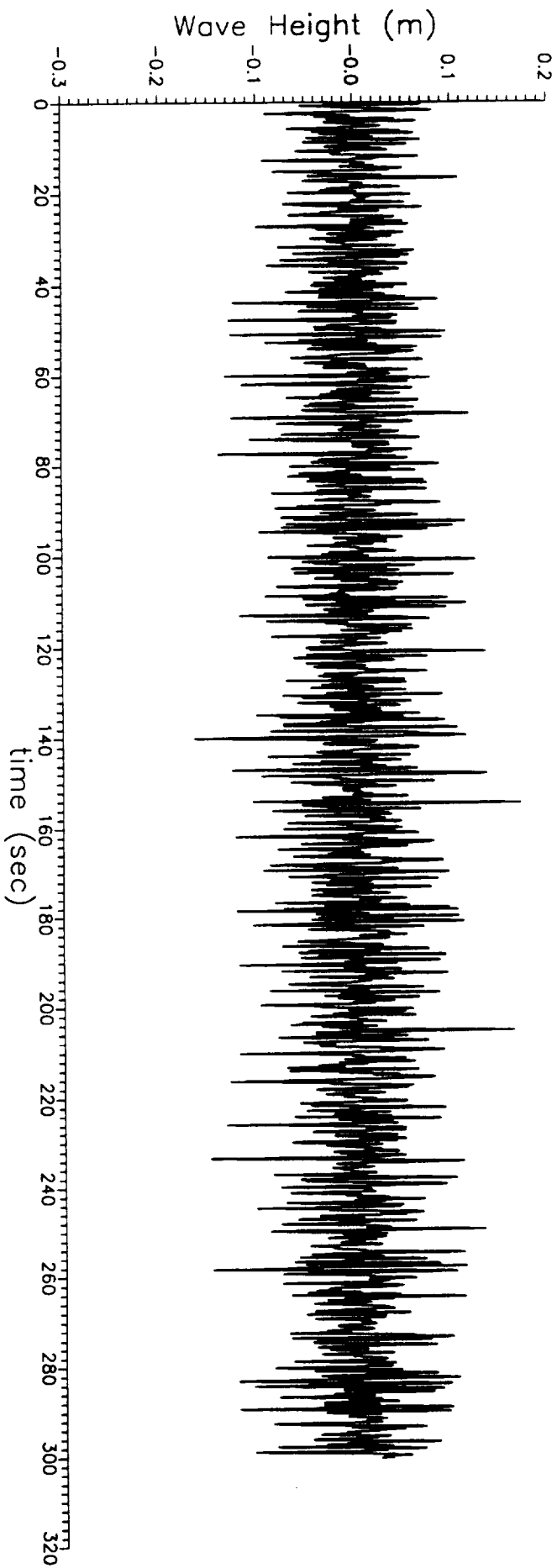
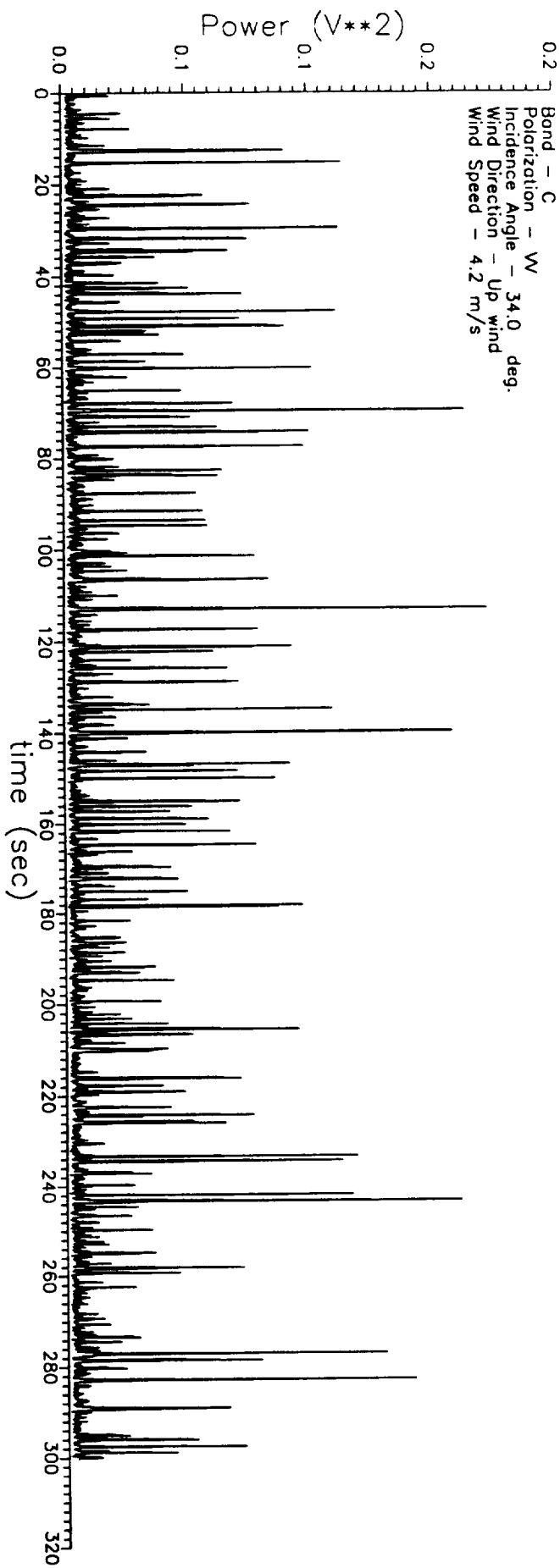
Run 10, 18:38, Aug 3, 1989

Band - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s



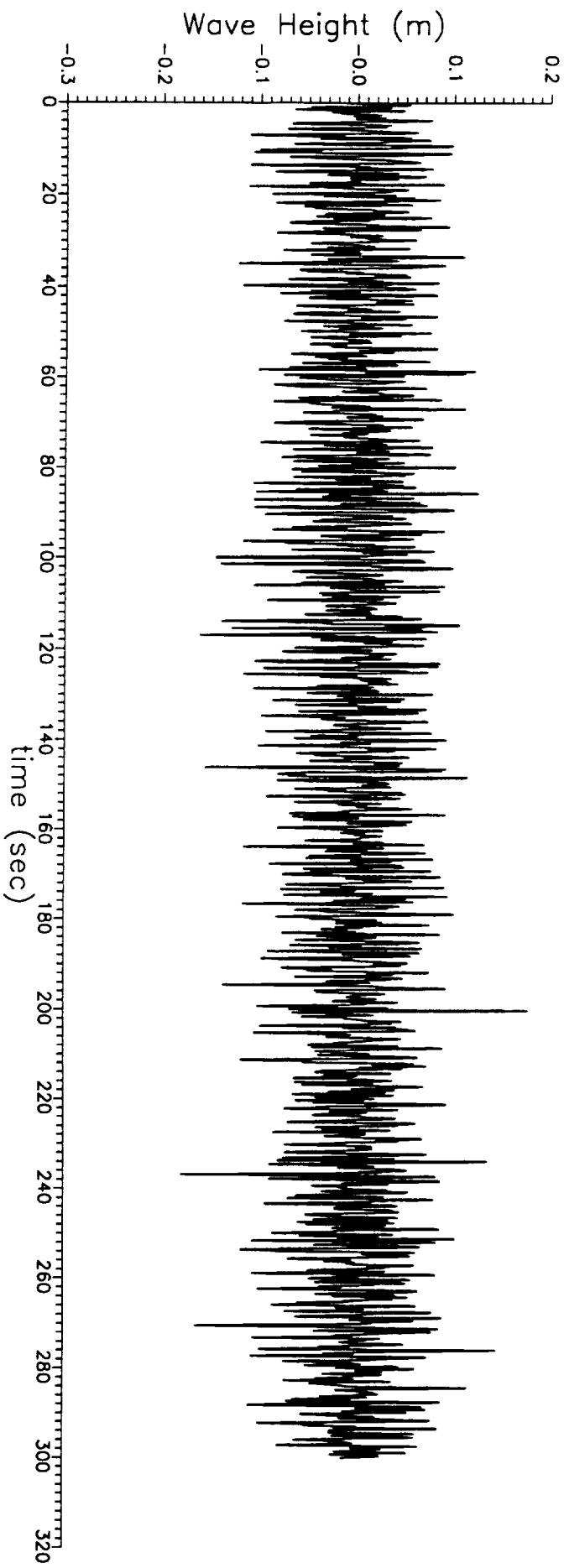
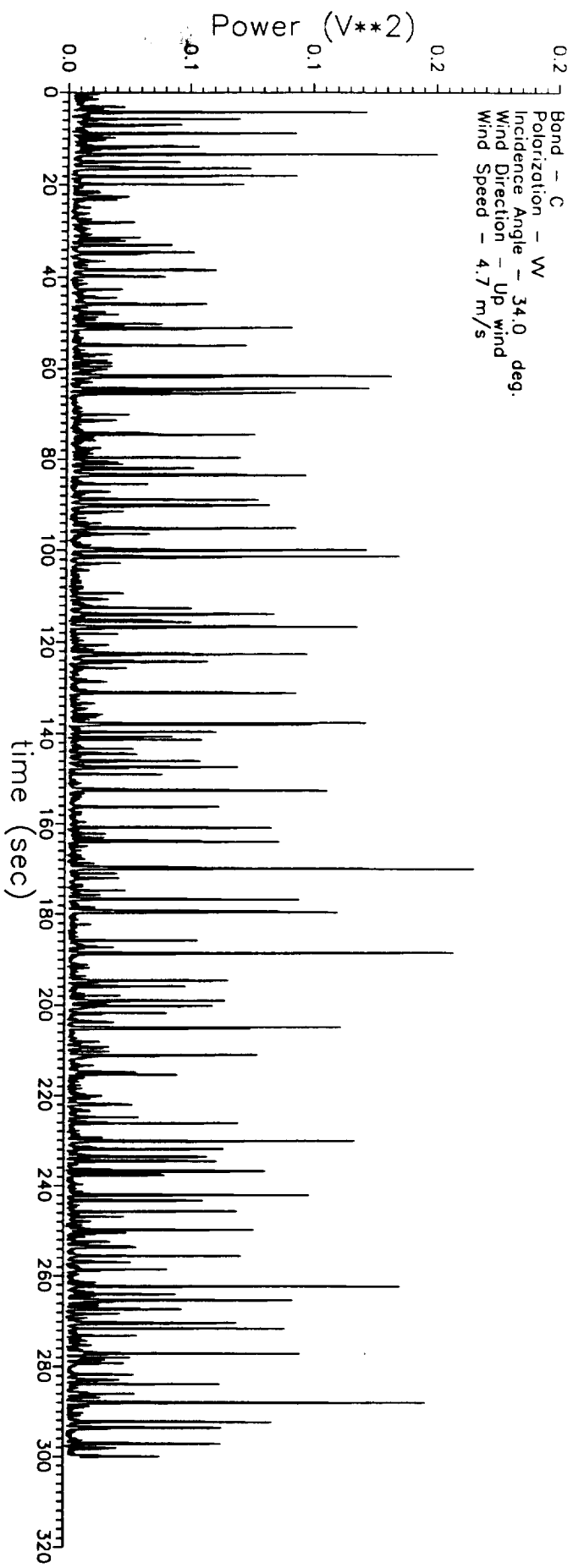
Run 15, 19:31, Aug 3, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s

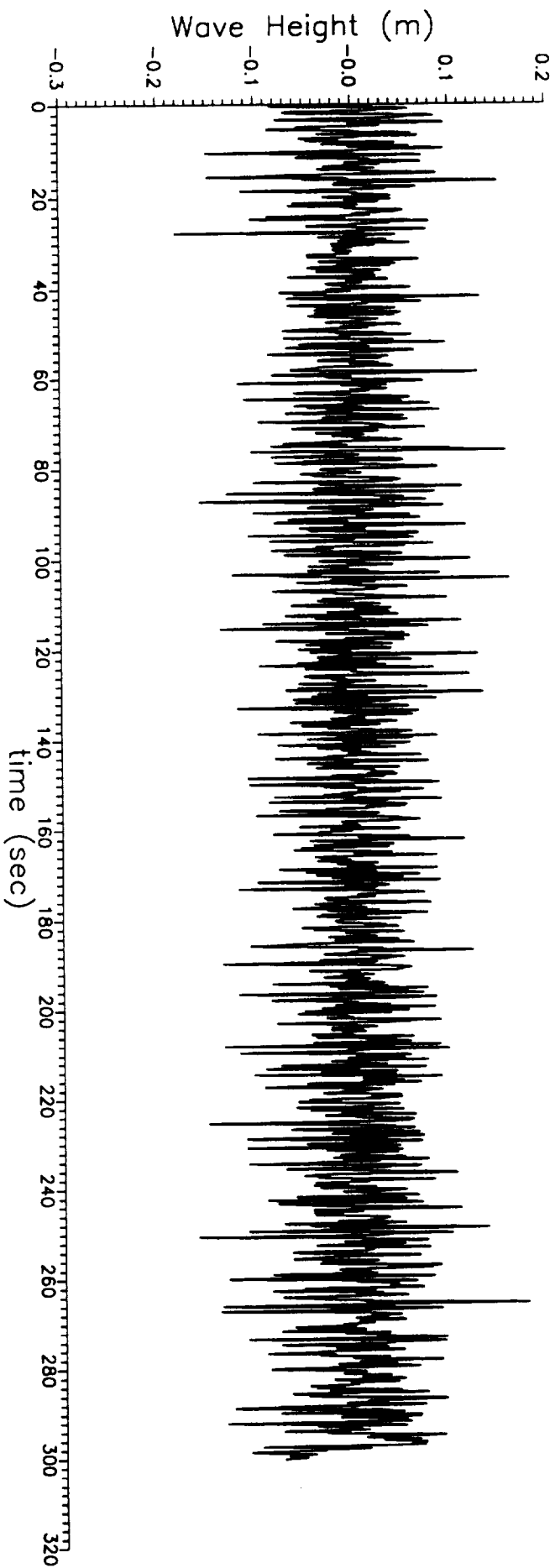
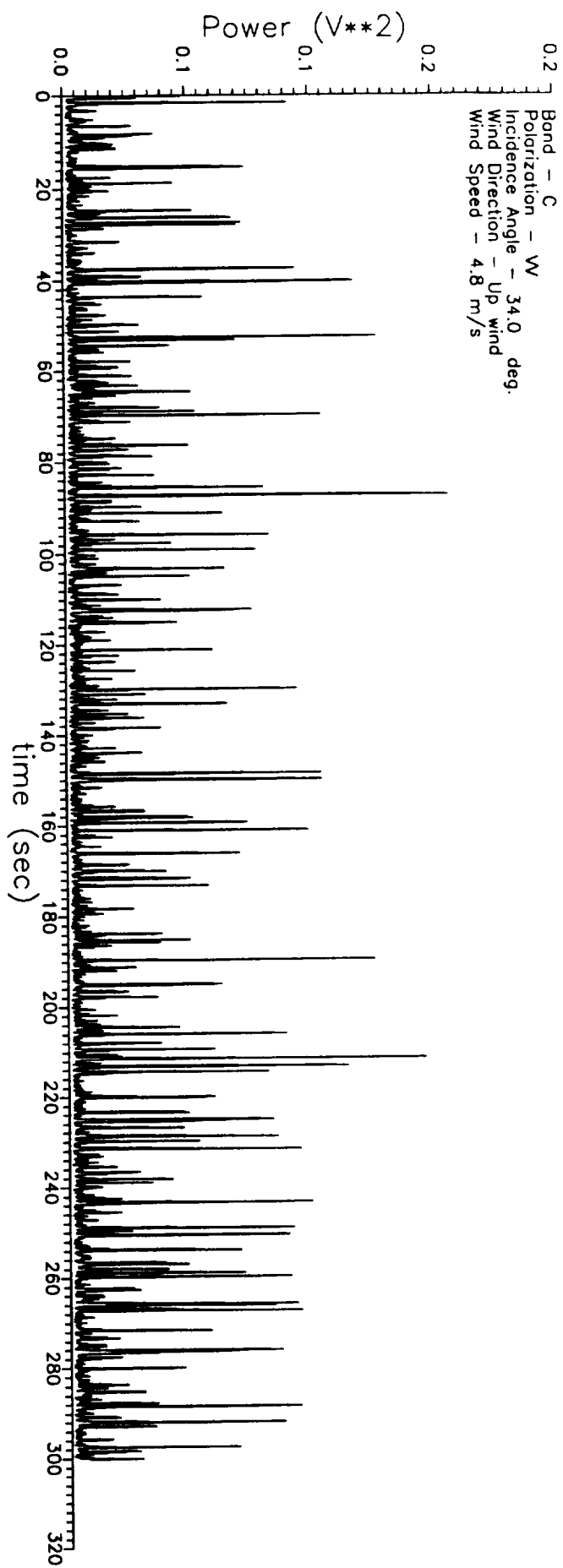


Run 16, 19:37, Aug 3, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.7 m/s

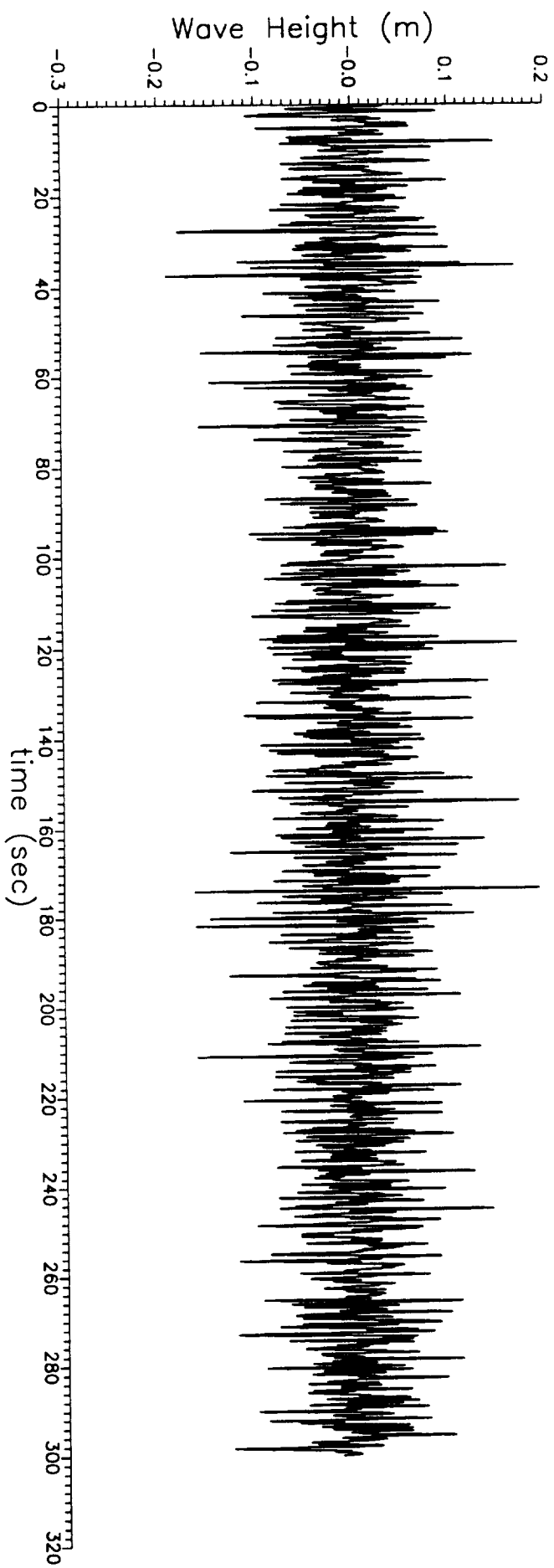
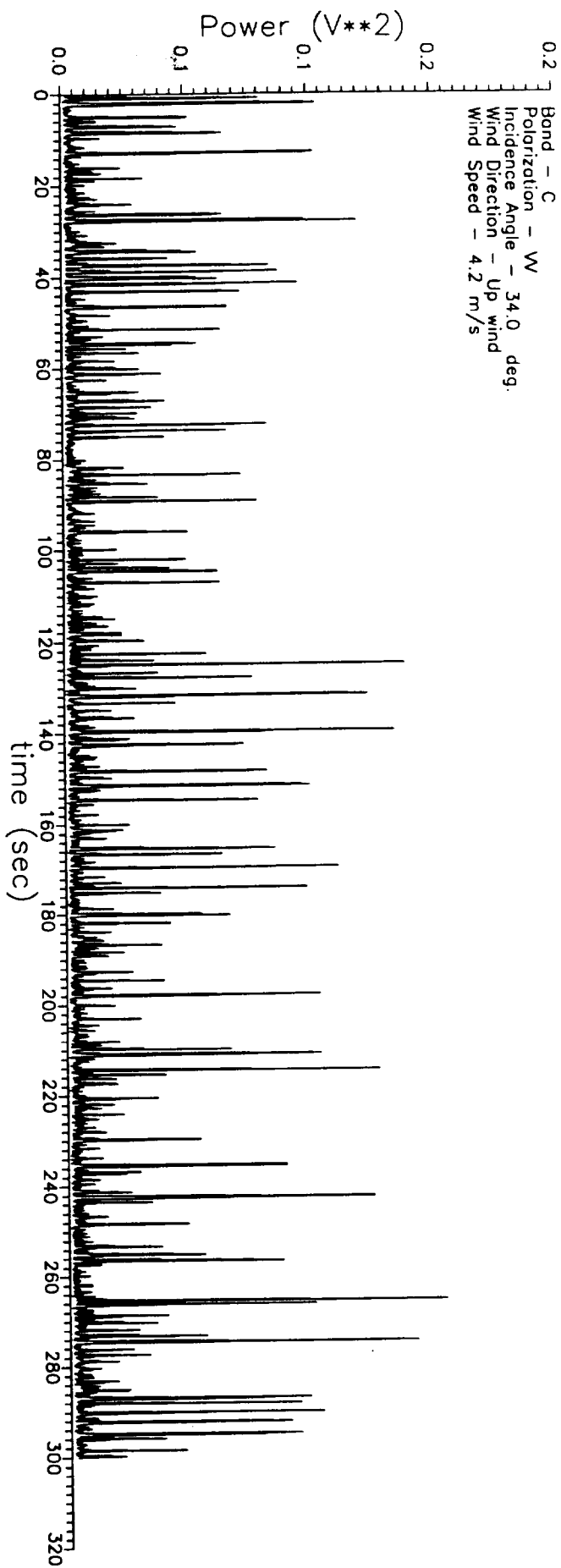


Run 17, 19:42, Aug 3, 1989



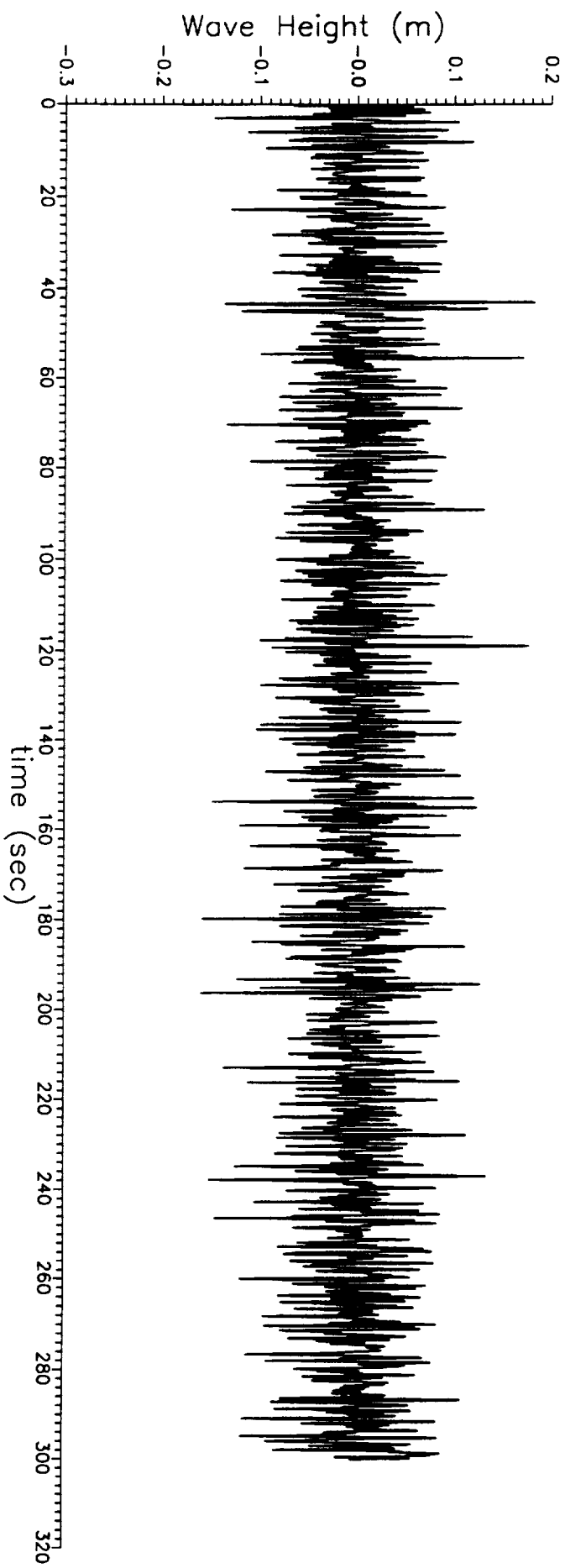
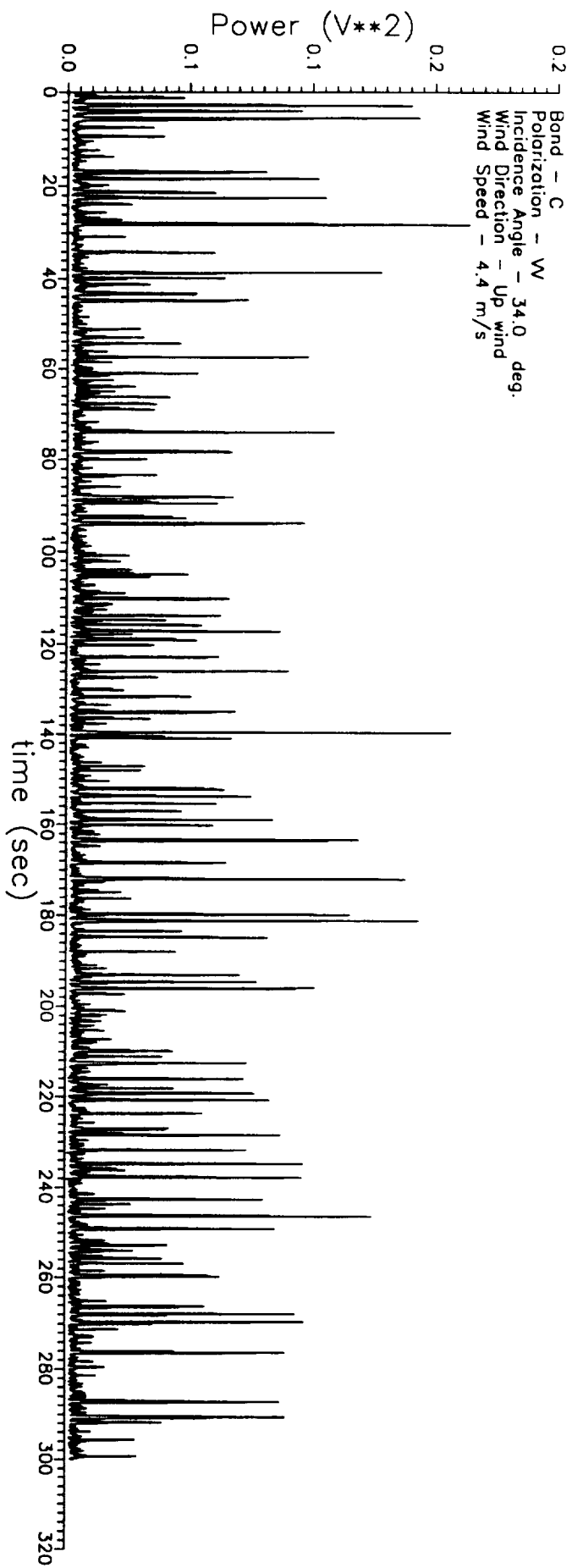
Run 18, 19:48, Aug 3, 1989

Bond - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s



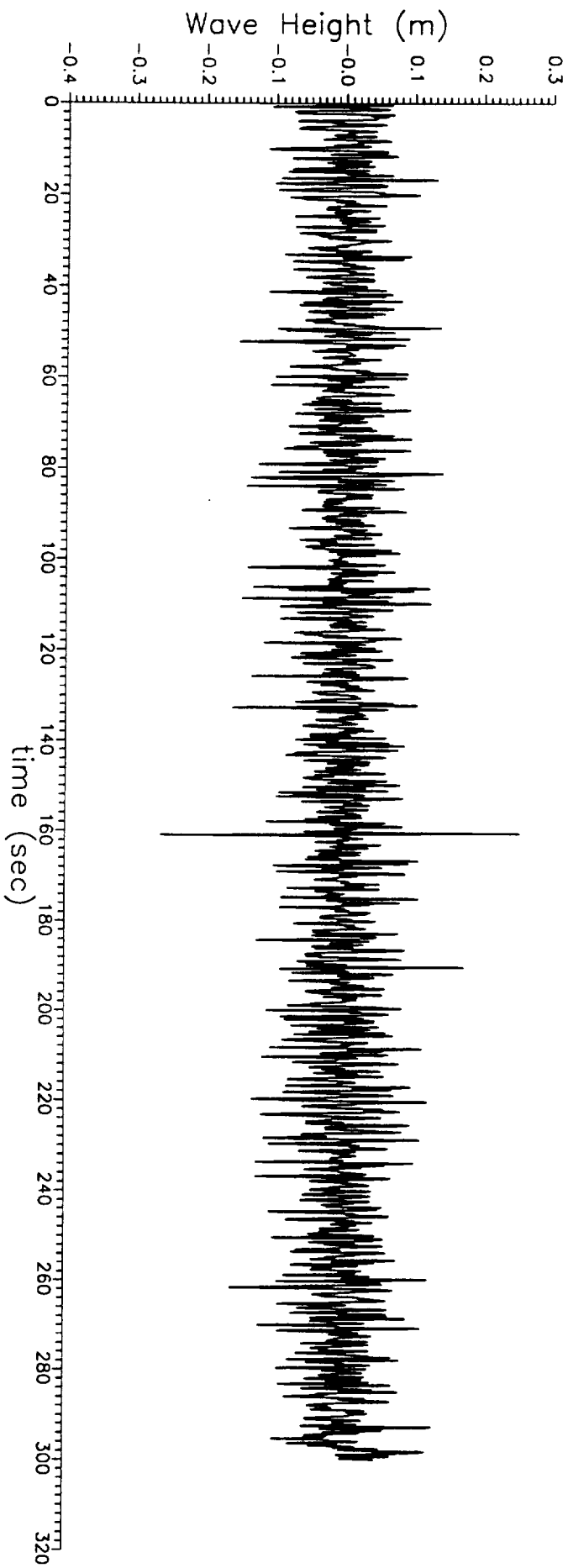
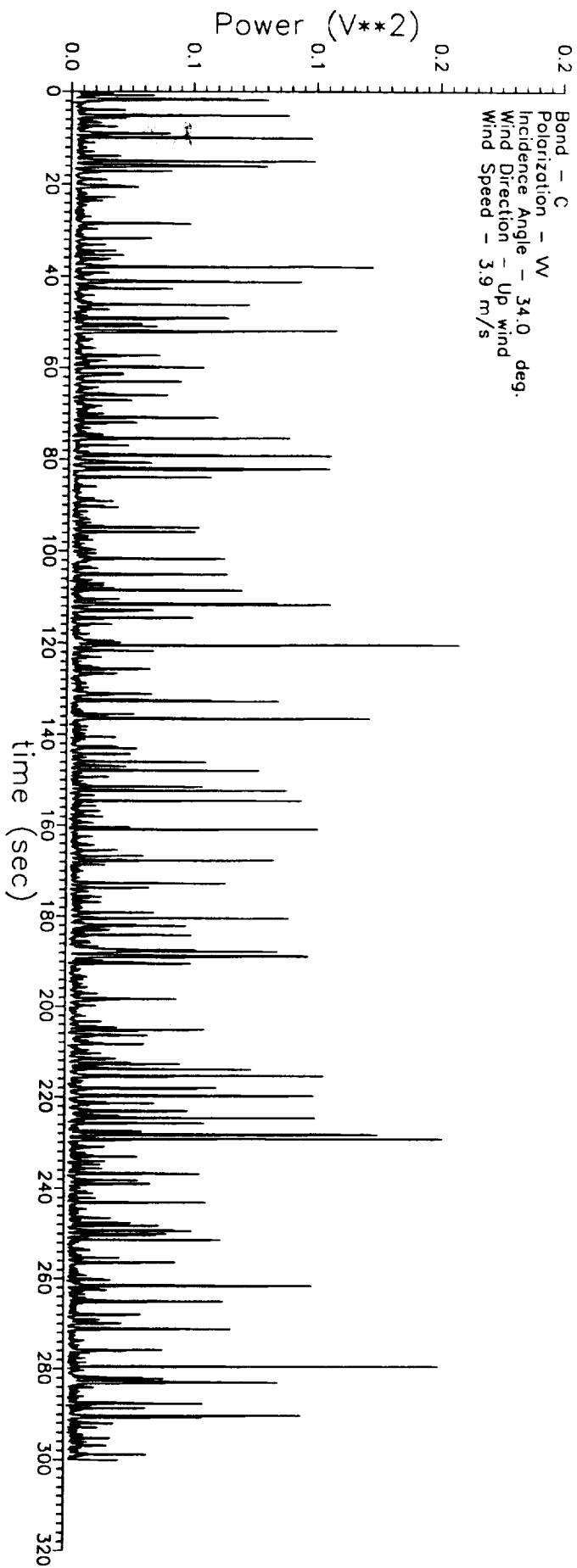
Run 19, 19:54, Aug 3, 1989

Bond - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s

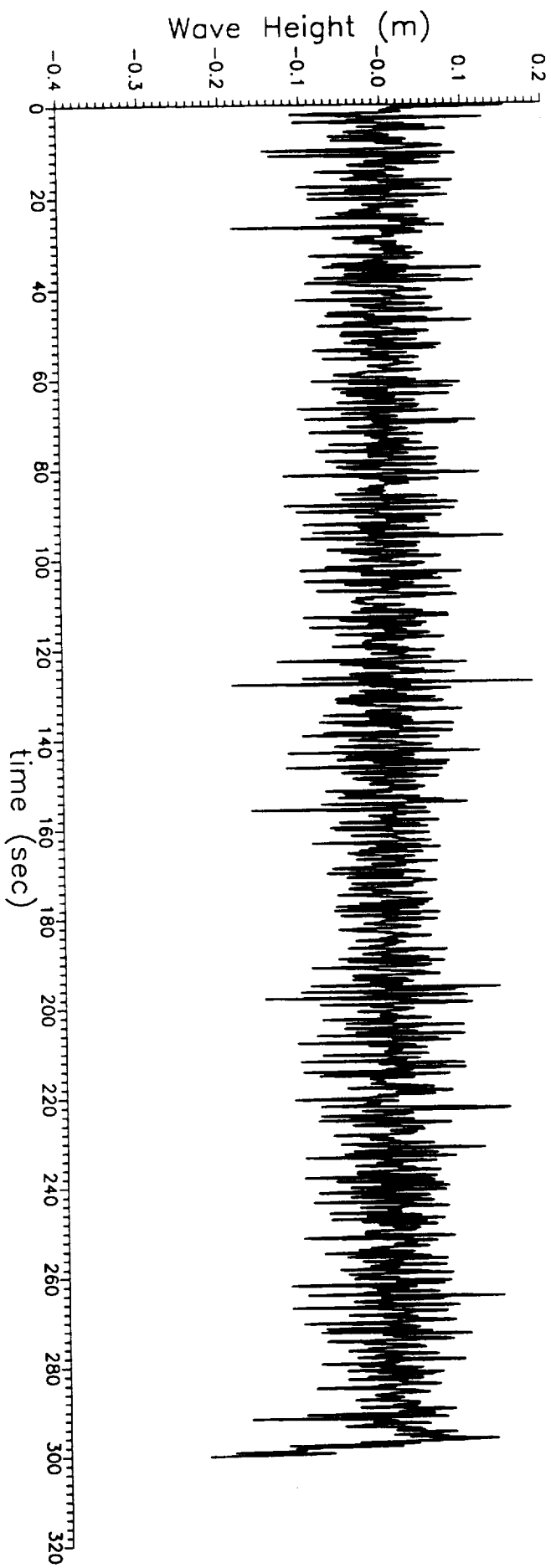
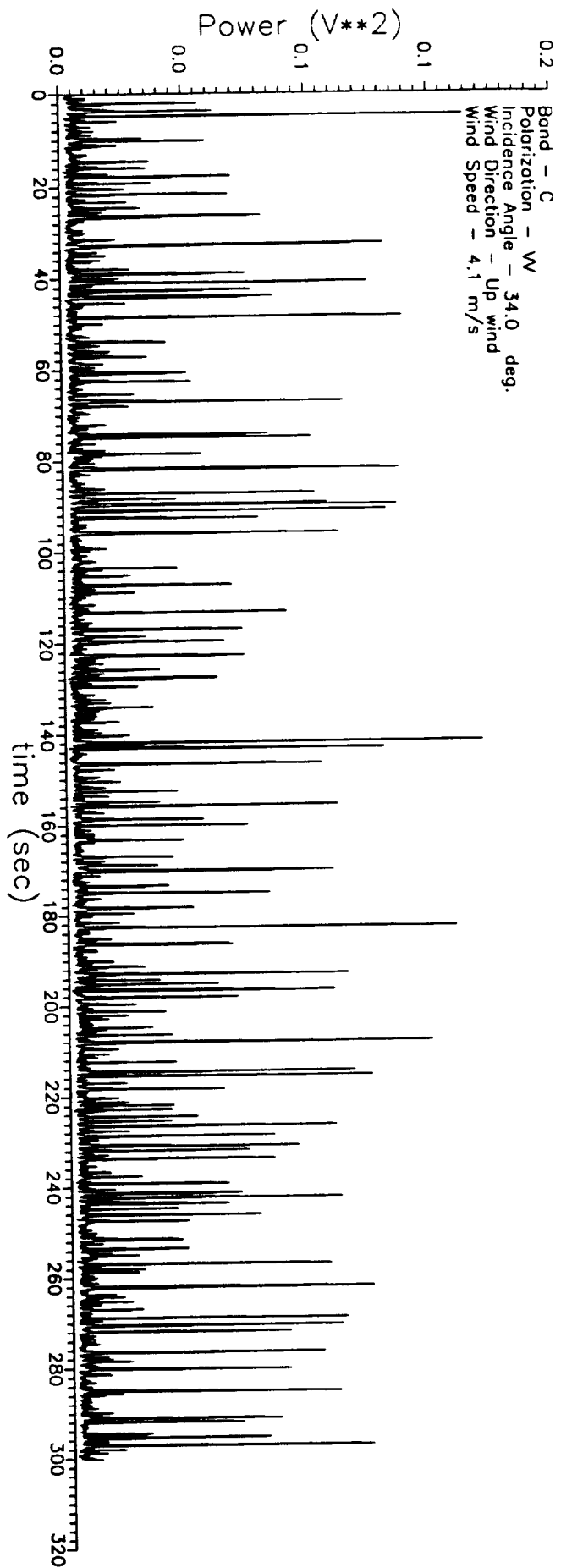


Run 20, 19:59, Aug 3, 1989

Bond - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s

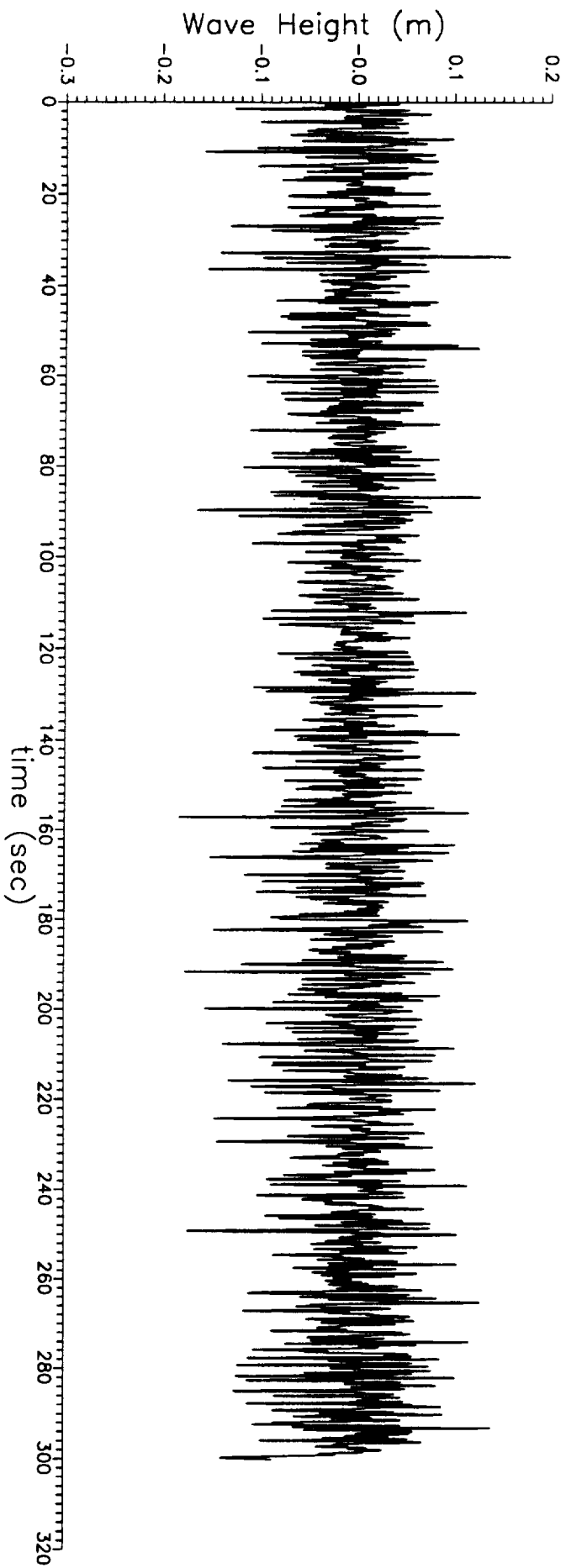
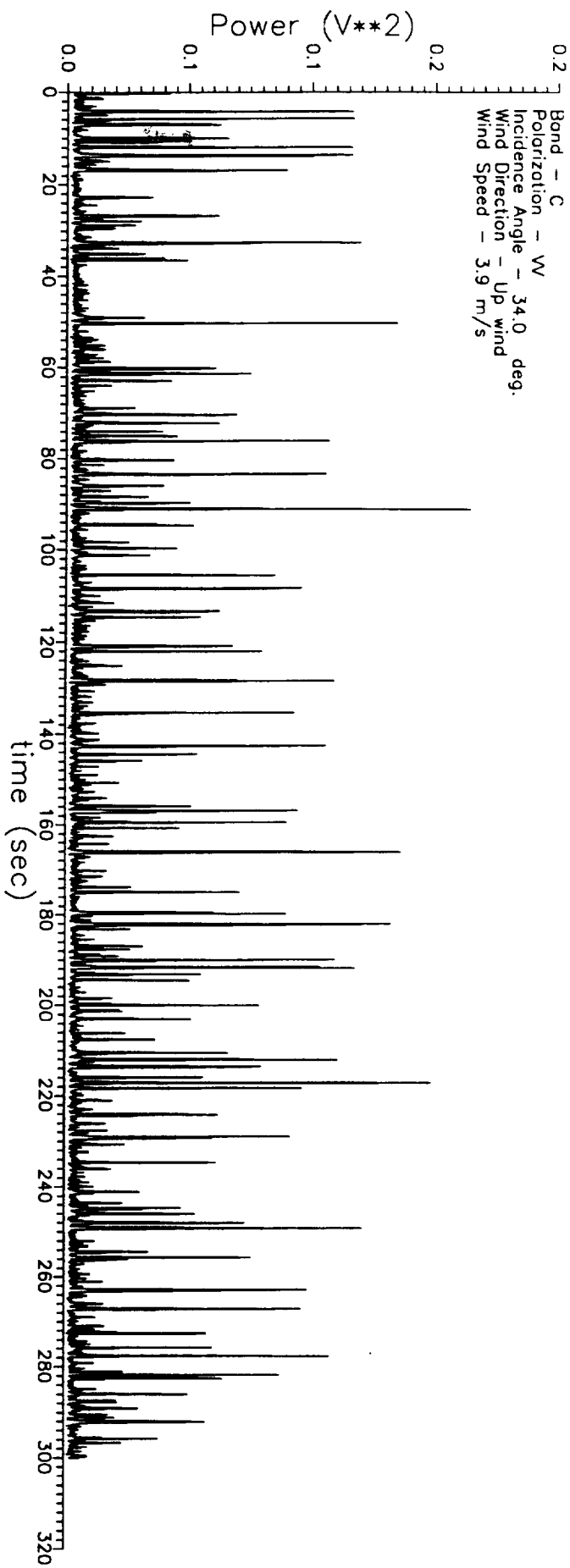


Run 22, 20:11, Aug 3, 1989



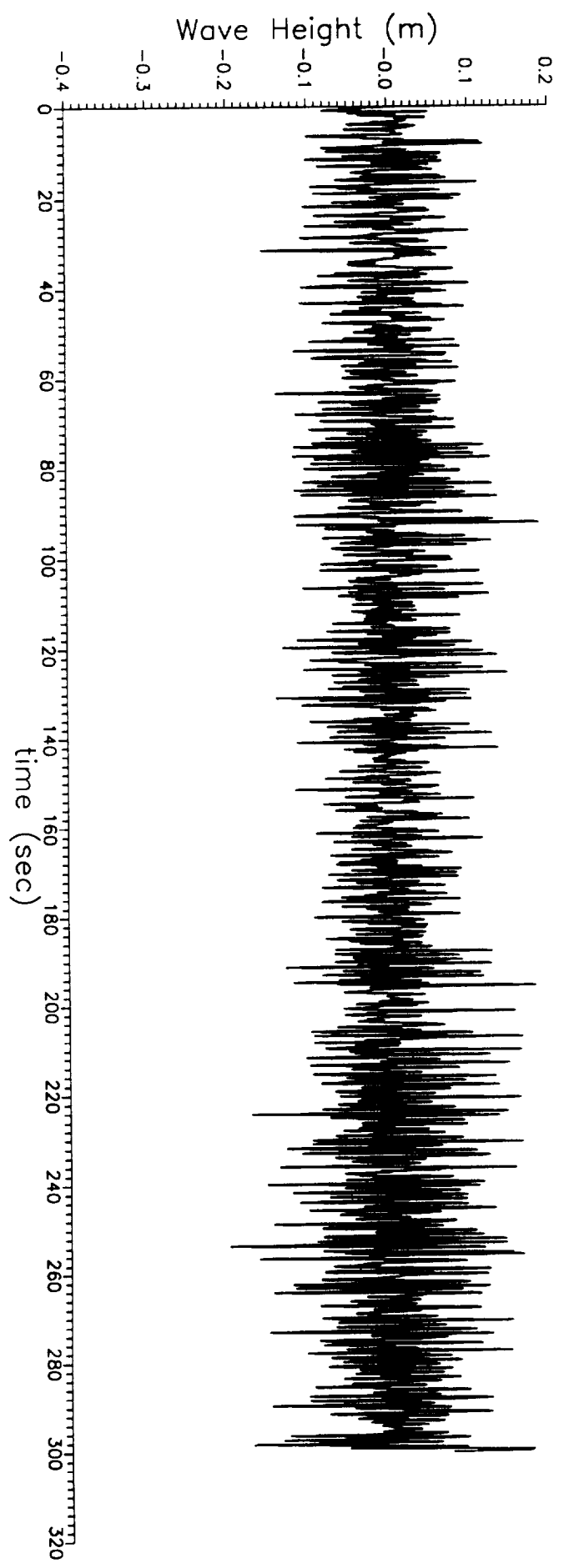
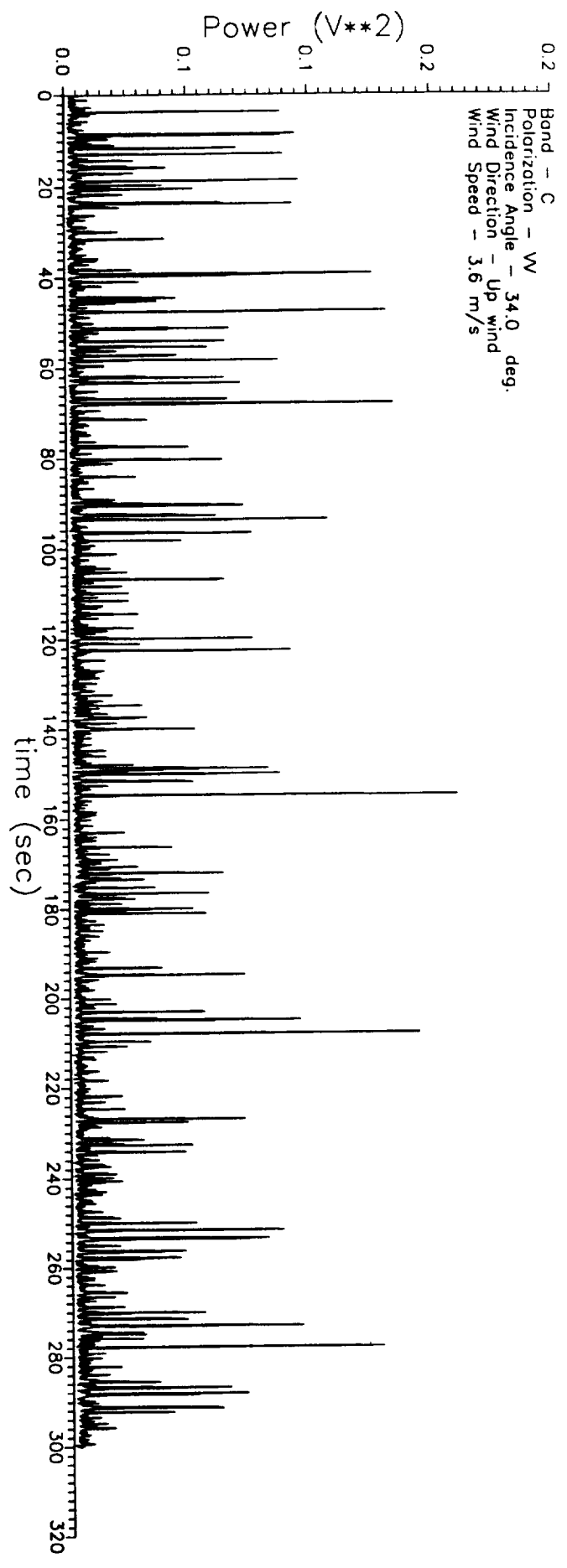
Run 23, 20:16, Aug 3, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s



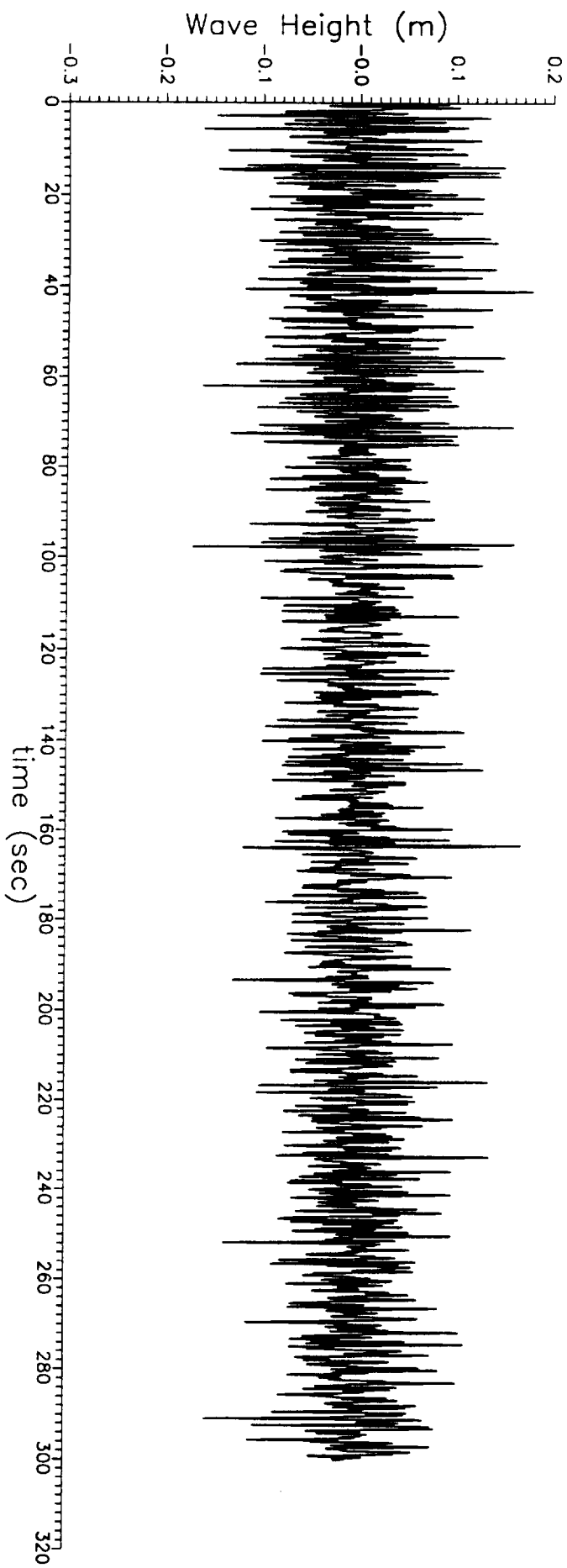
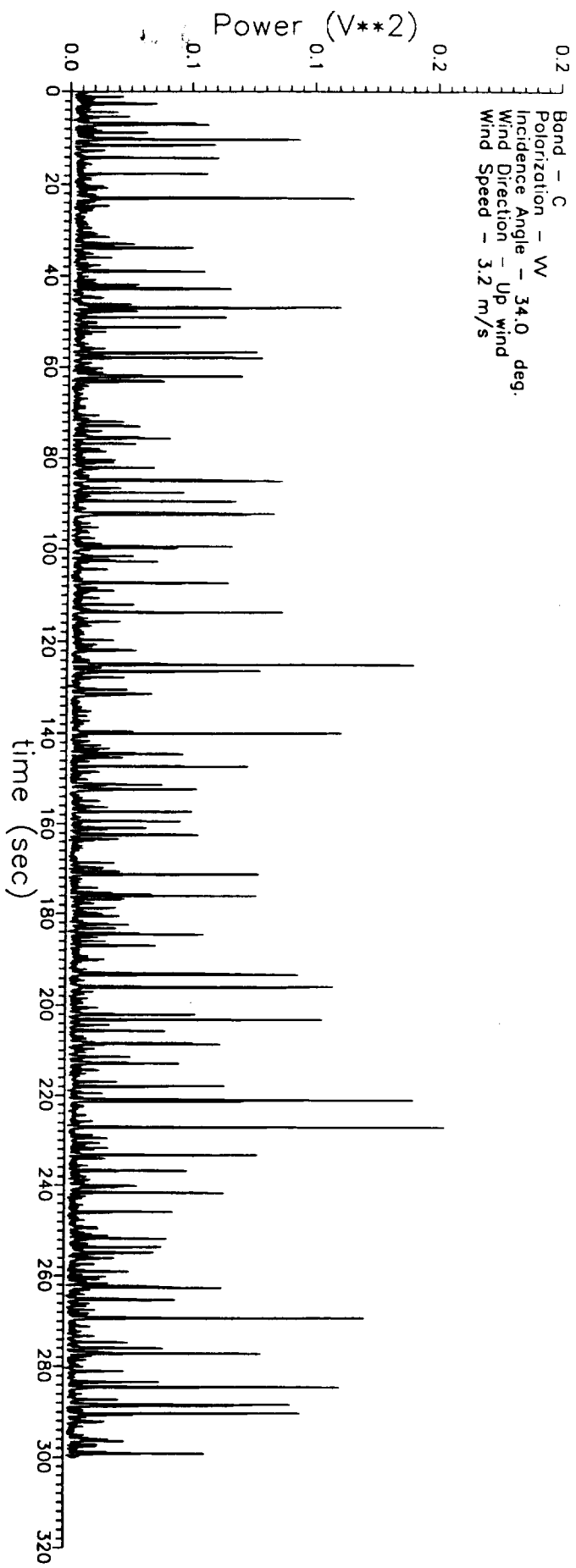
Run 25, 20:28, Aug 3, 1983

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.6 m/s



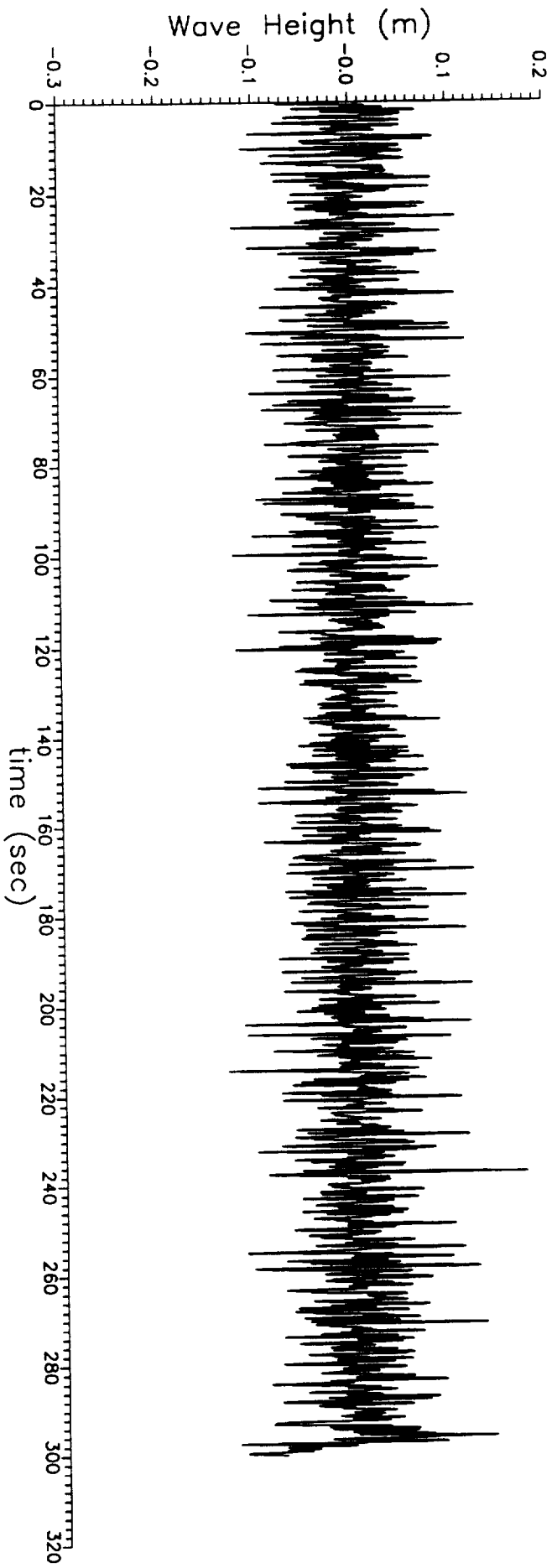
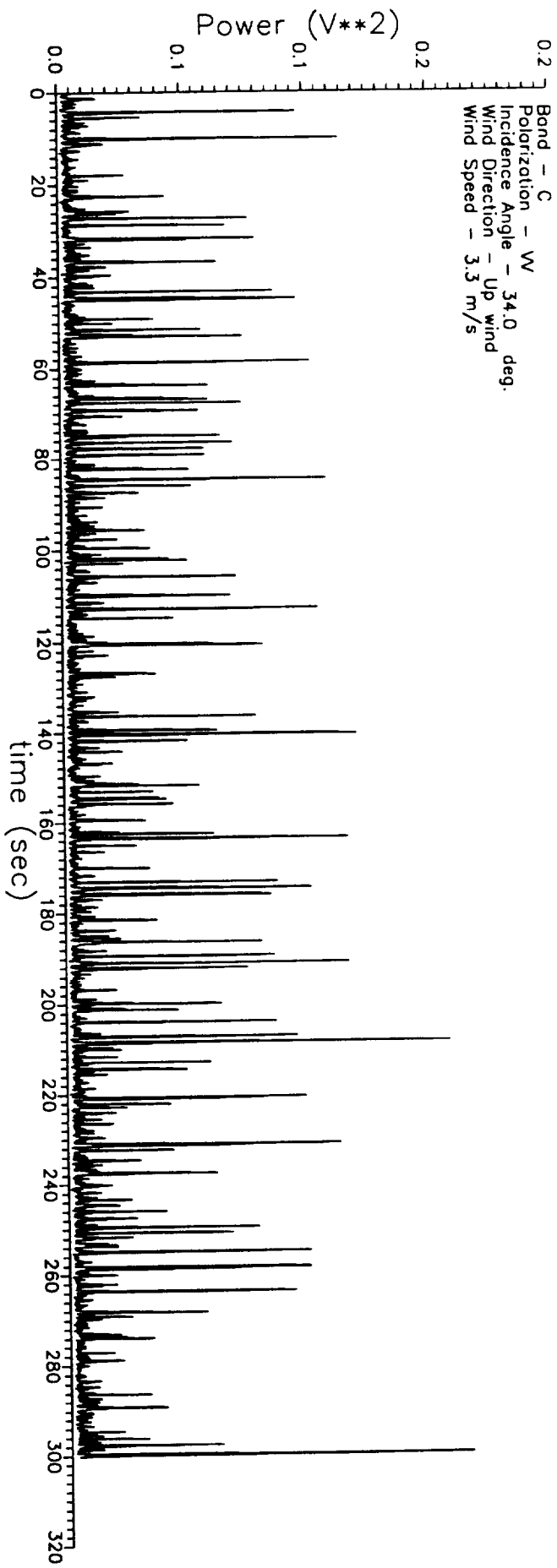
Run 26, 20:35, Aug 3, 1989

Band - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.2 m/s



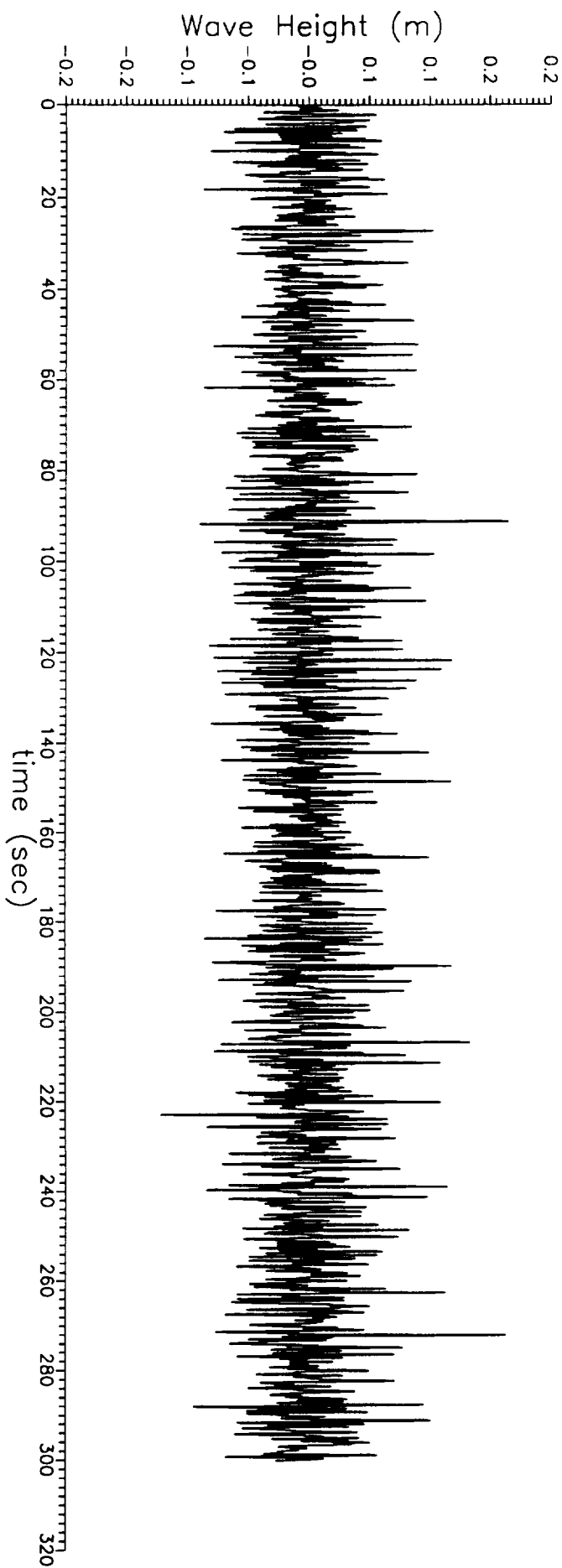
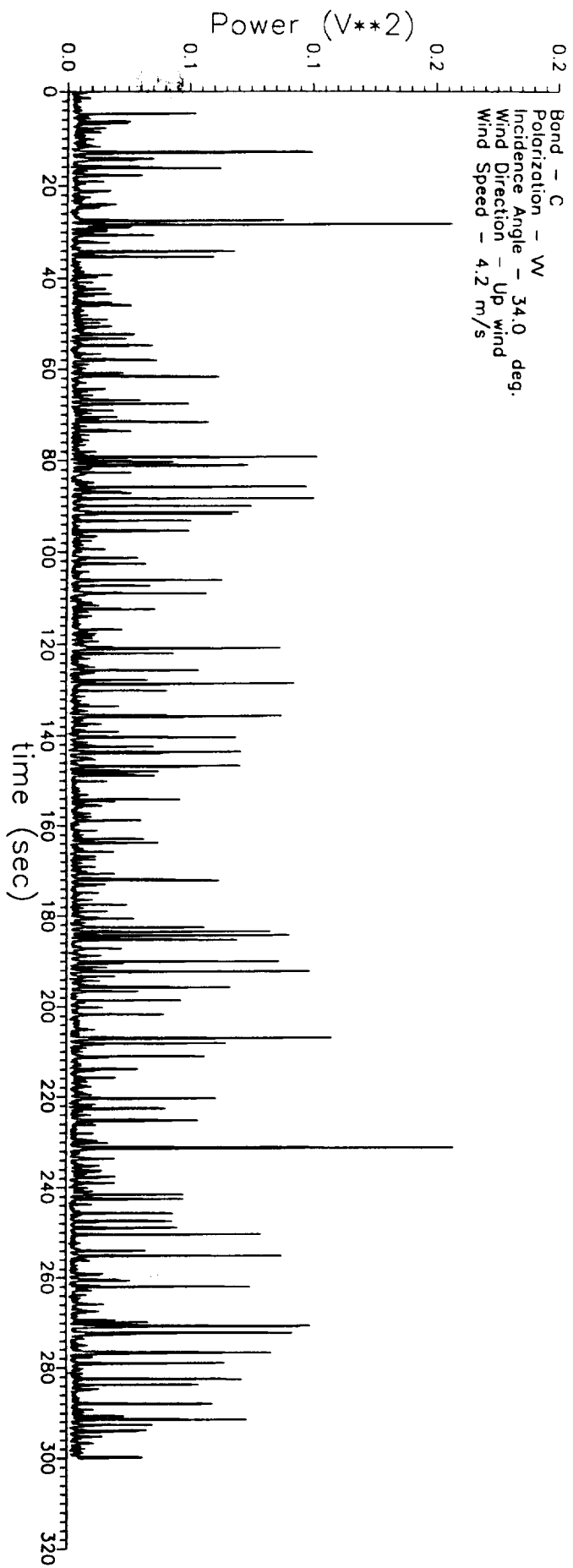
Run 27, 20:39, Aug 3, 1989

Band - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.3 m/s



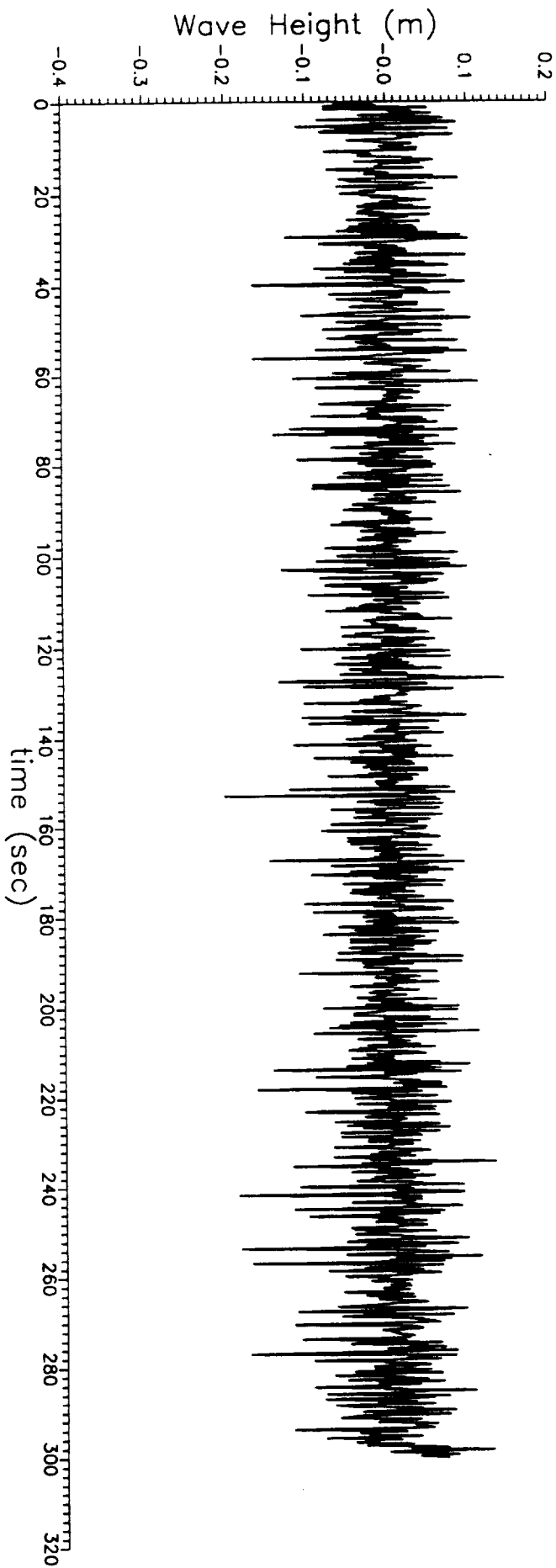
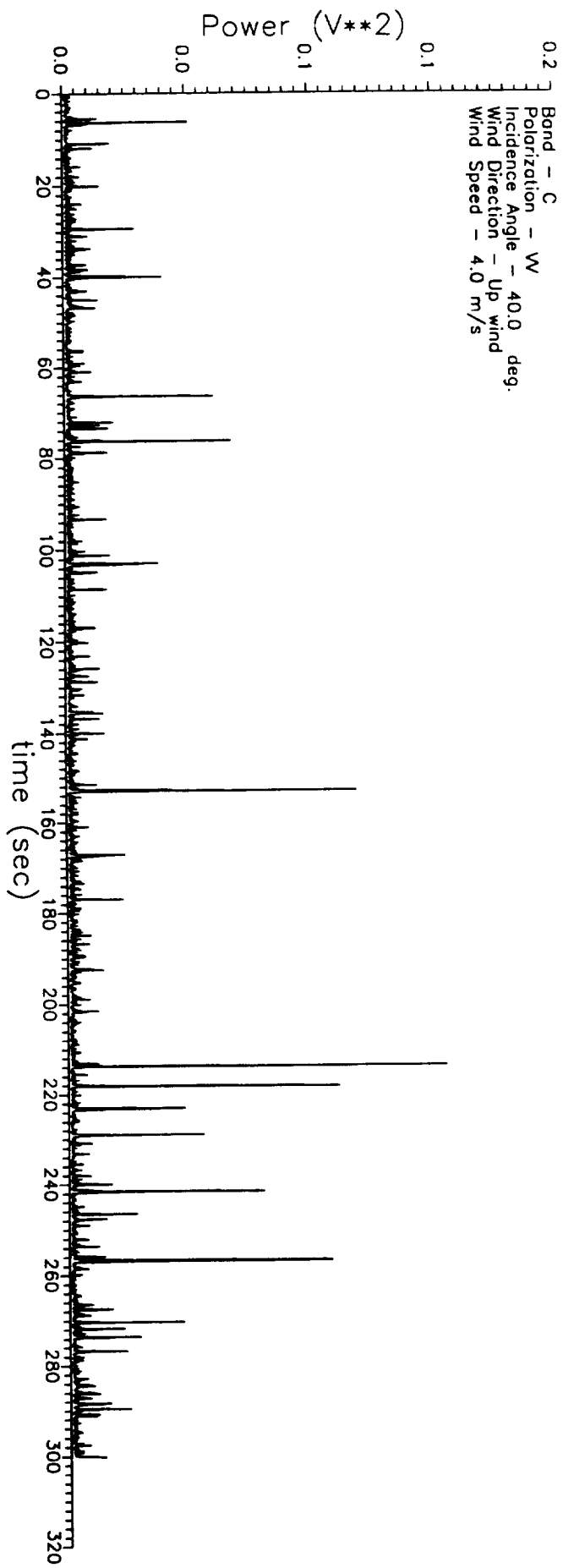
Run 27, 18:29, Aug 4, 1989

Band - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s

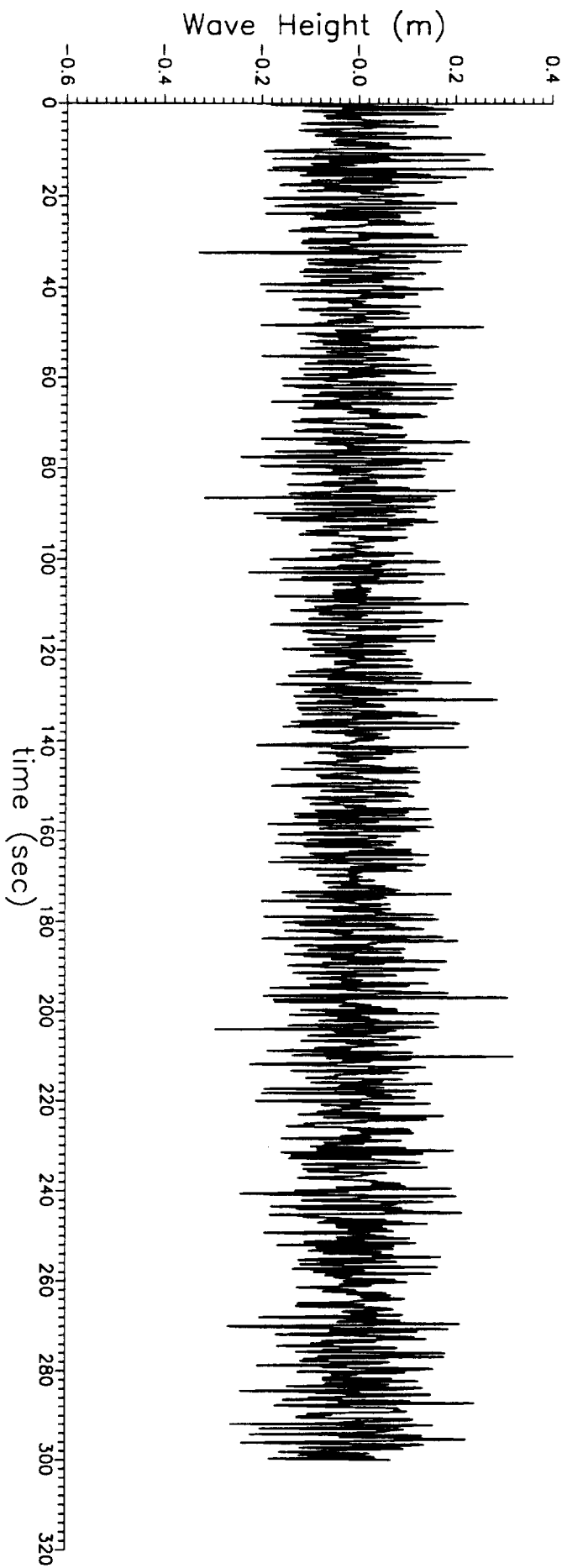
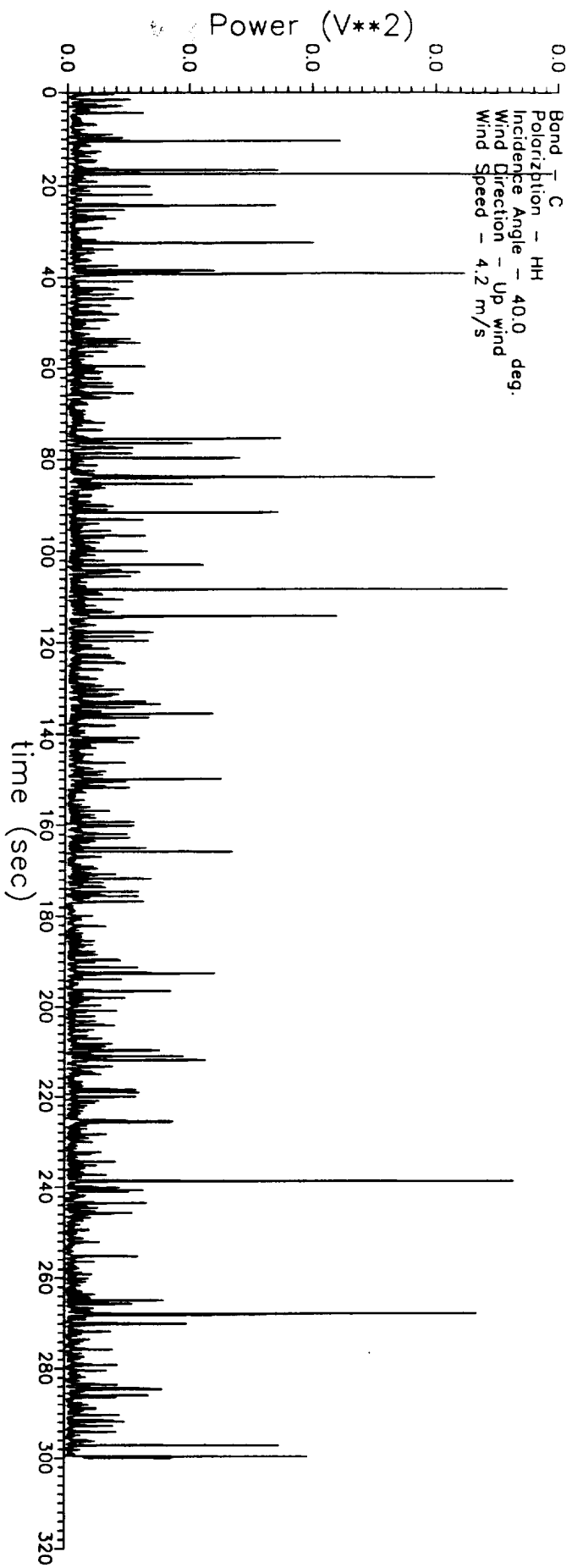


Run 36, 19:50, Aug 4, 1989

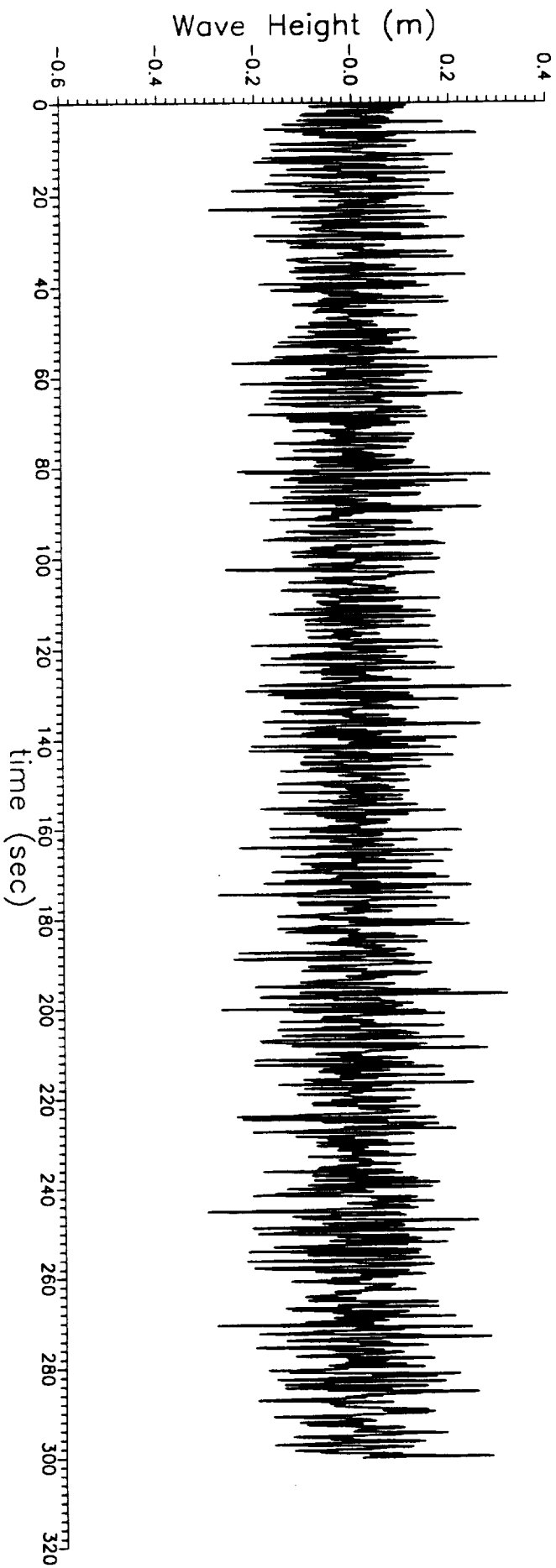
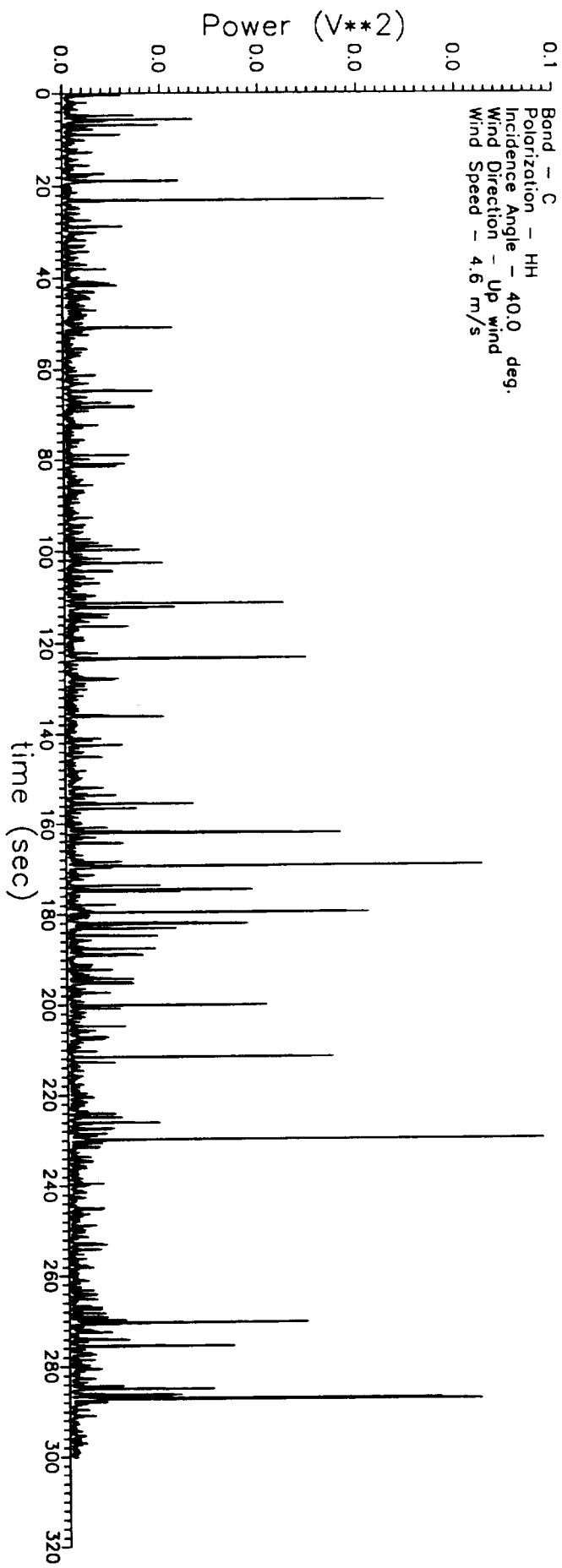
Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.0 m/s



Run 39, 20:16, Aug 4, 1989

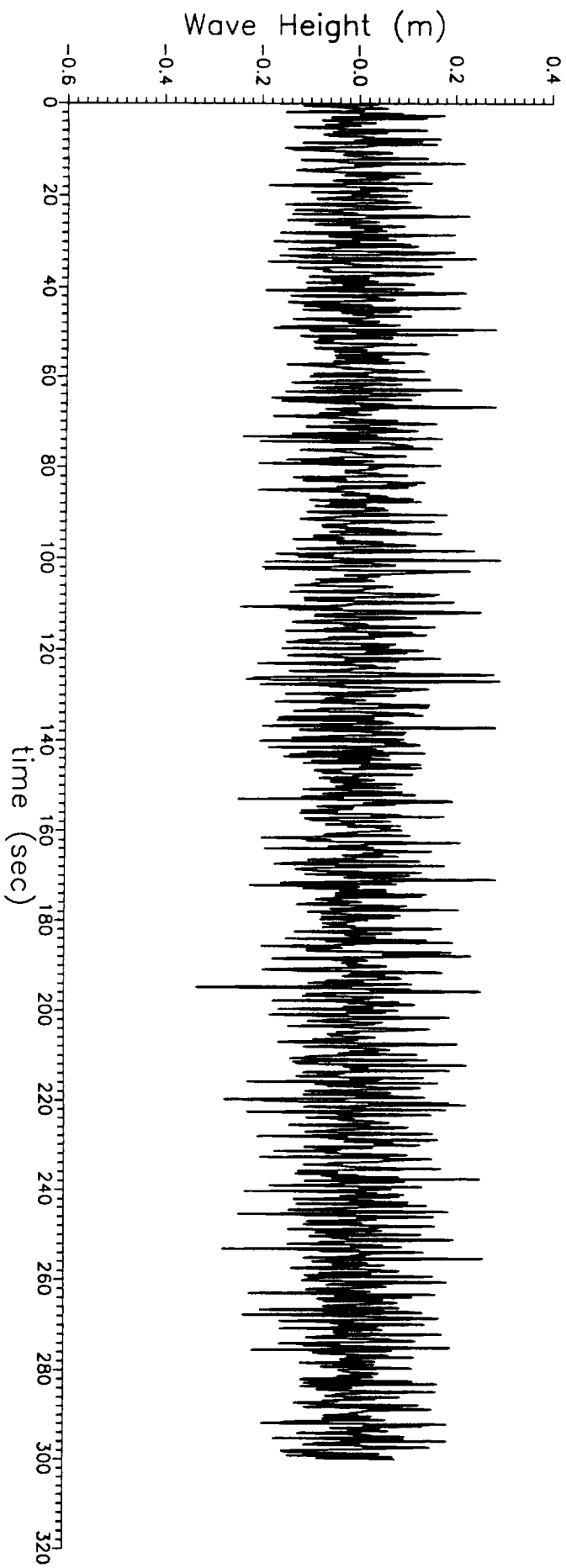
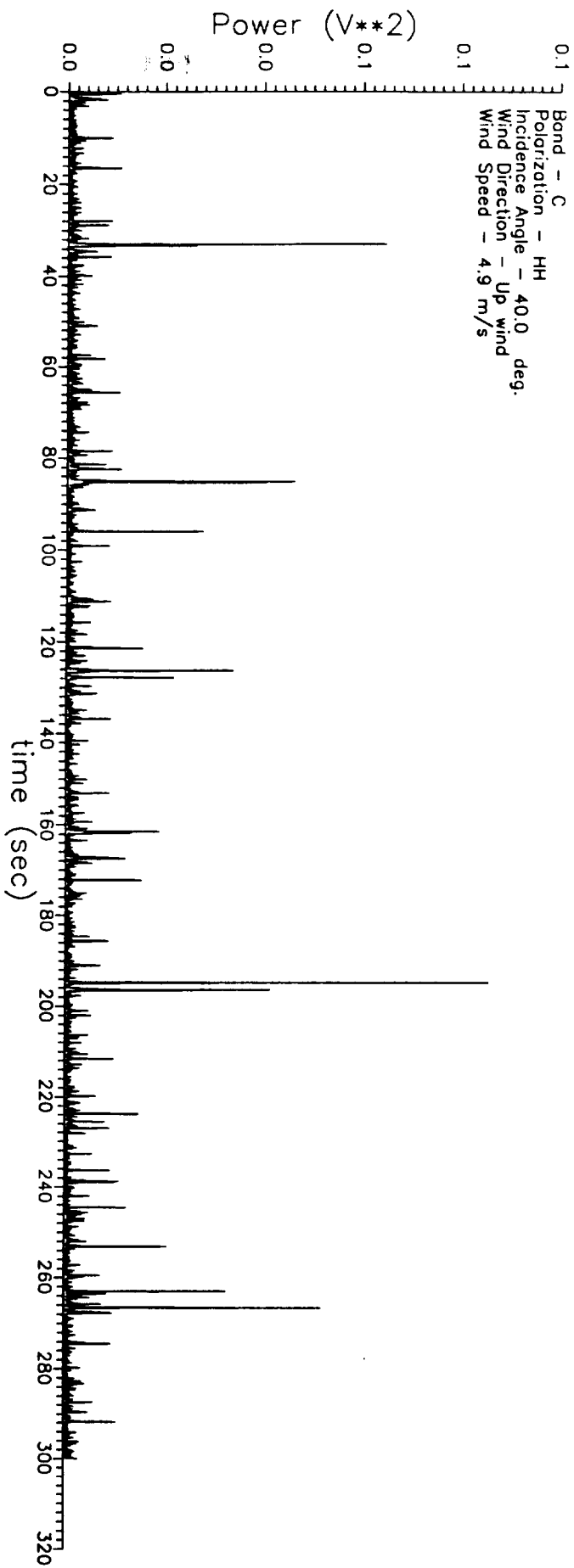


Run 40, 20:22, Aug 4, 1989

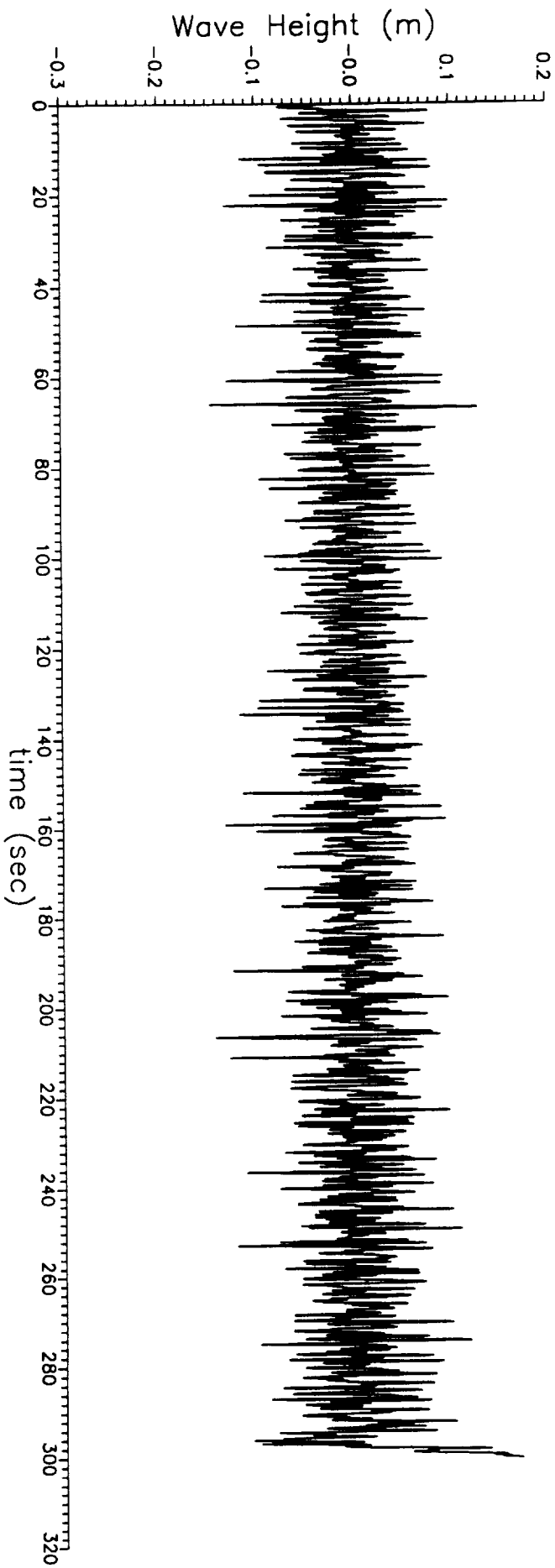
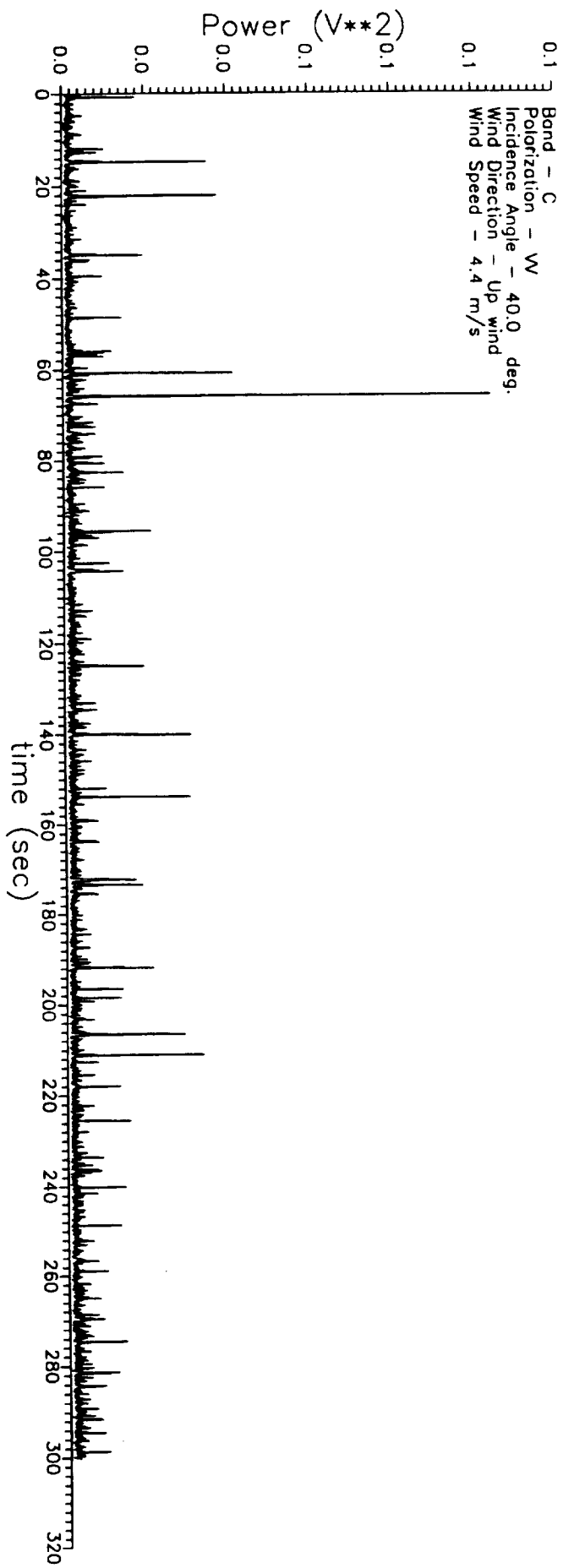


Run 41, 20:28, Aug 4, 1989

Bond - C
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.9 m/s

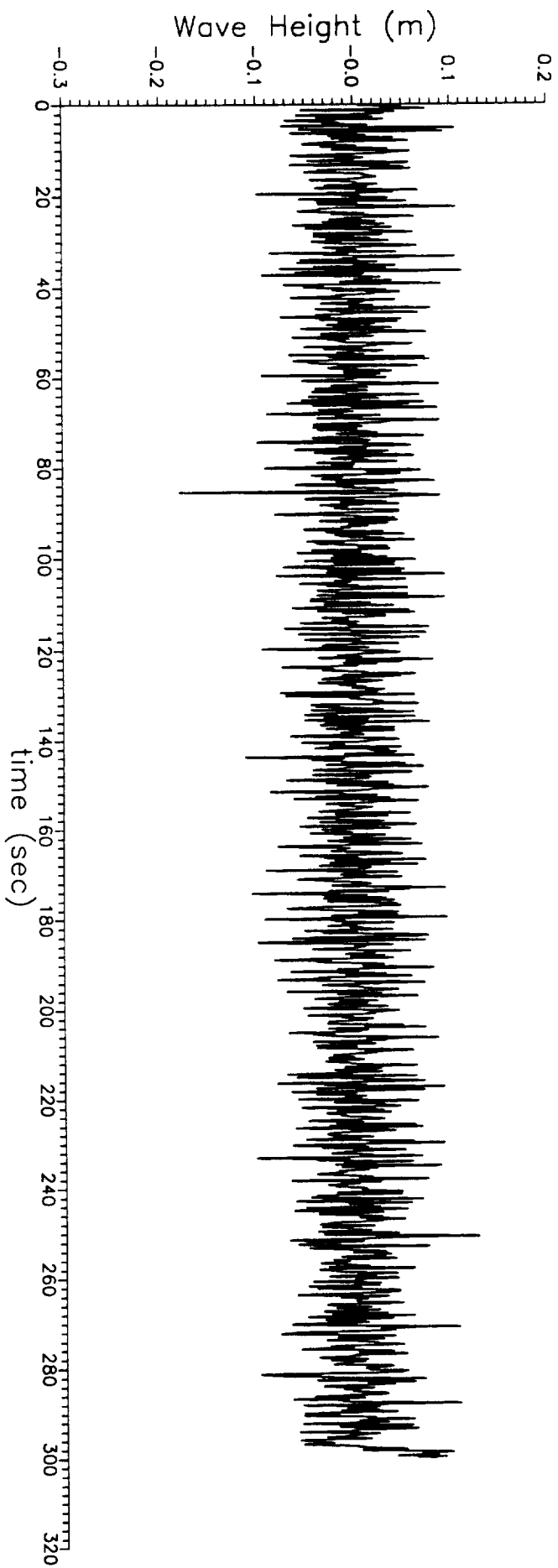
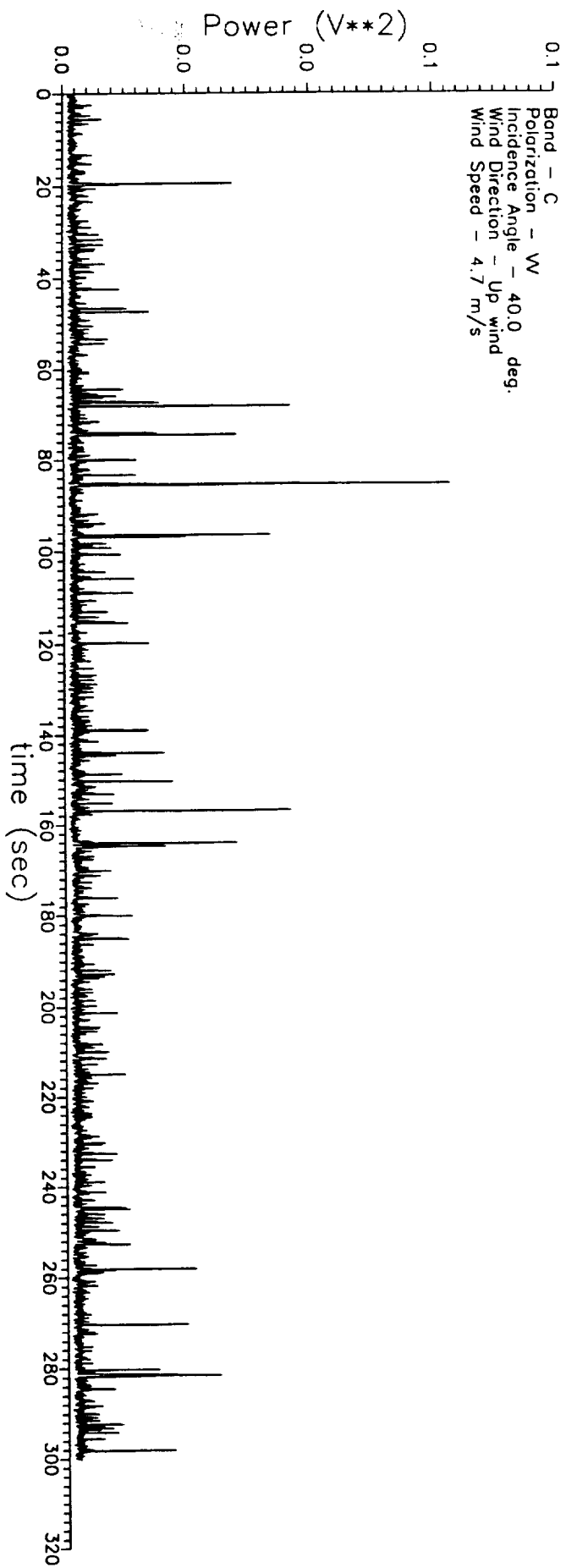


Run 42, 20:40, Aug 4, 1989



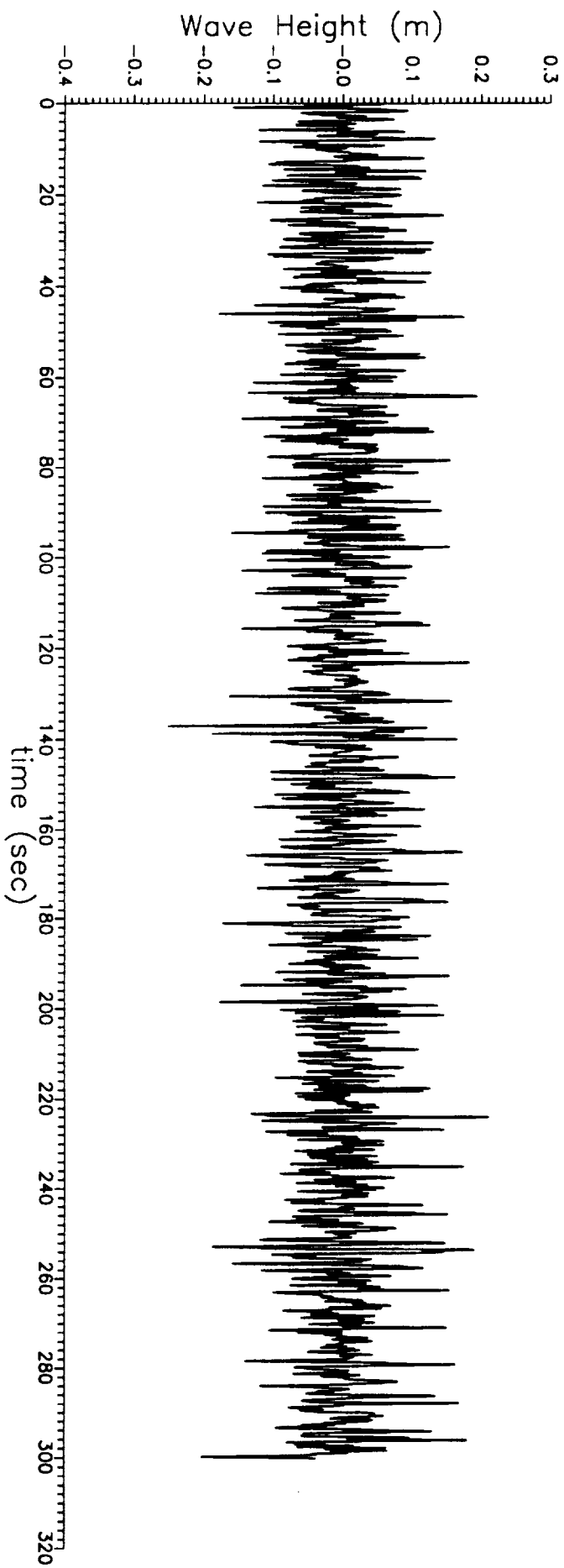
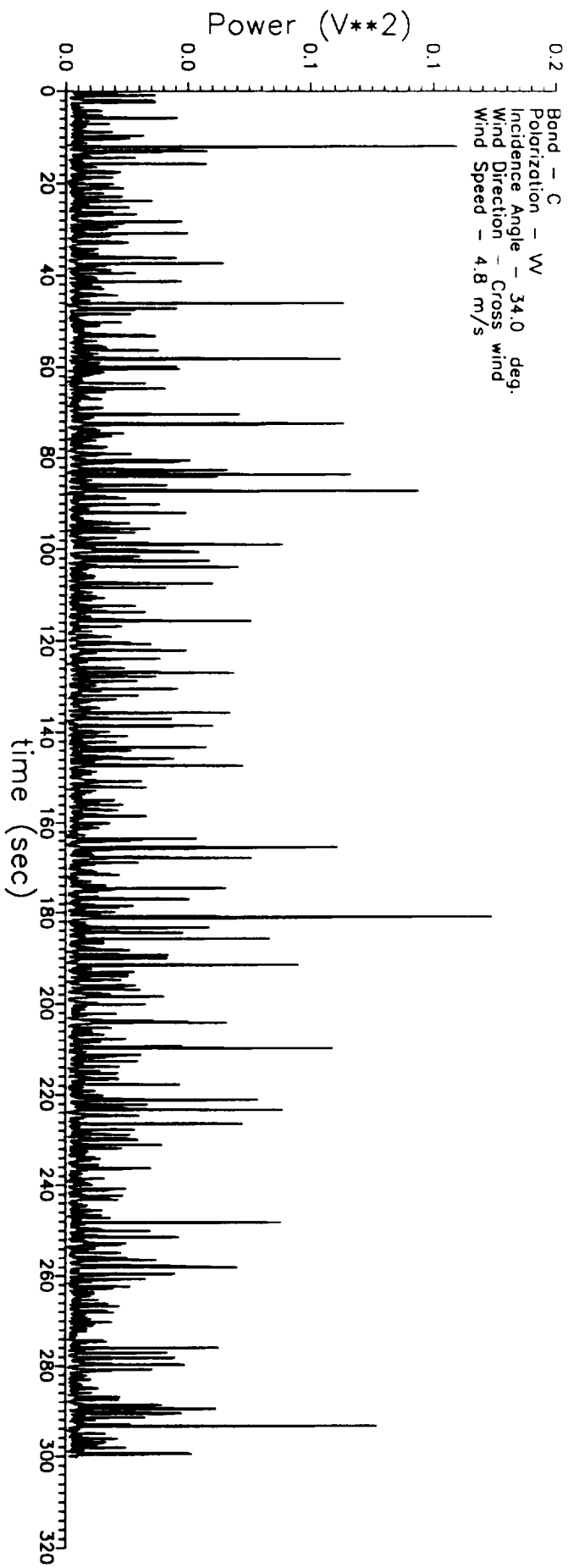
Run 43, 20:46, Aug 4, 1989

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.7 m/s



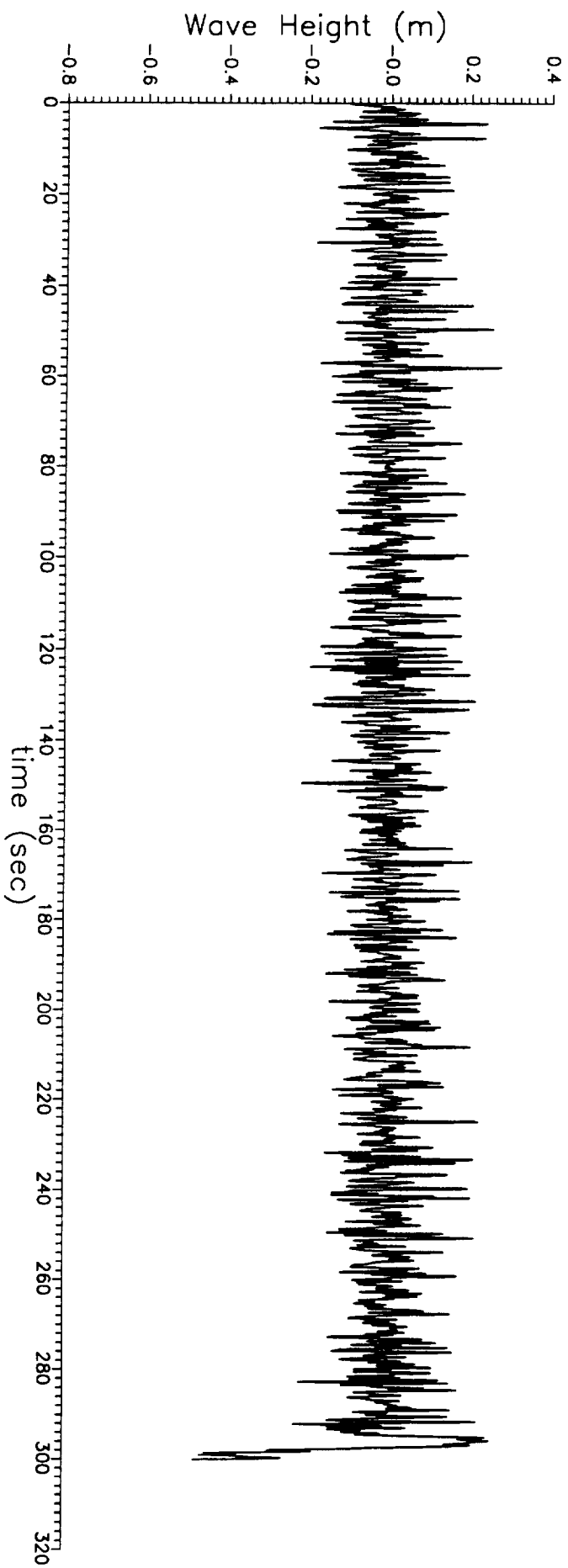
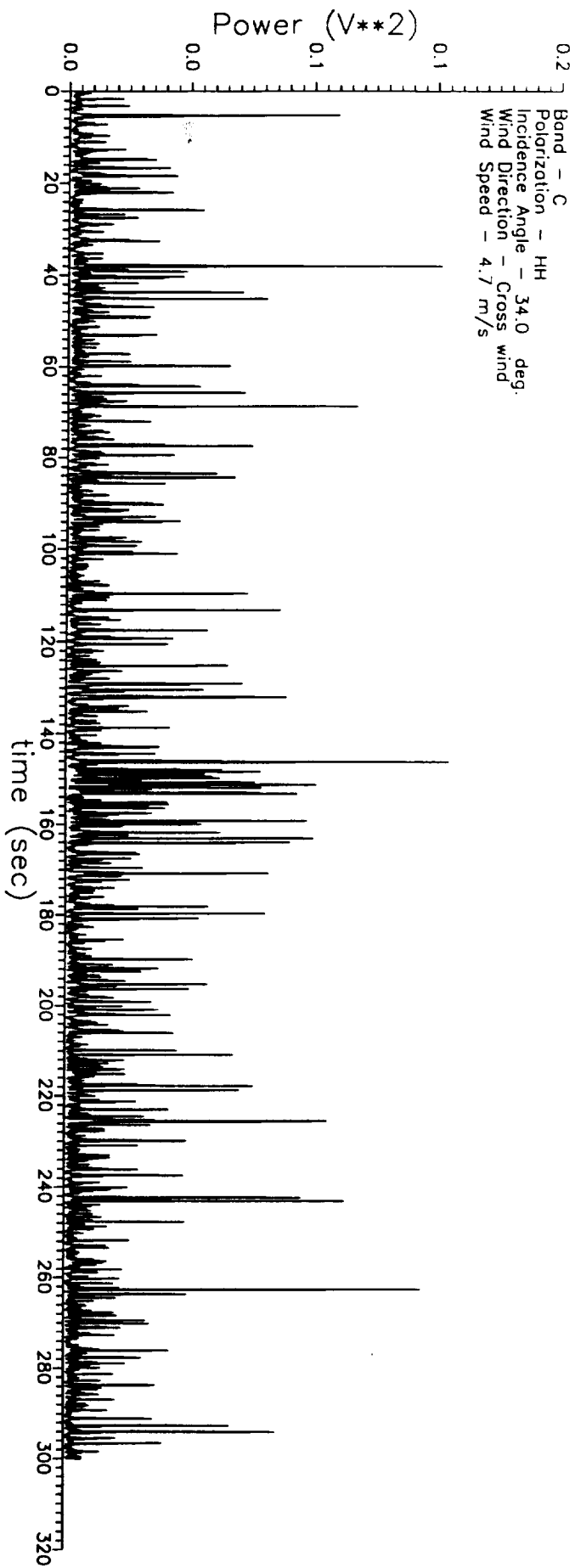
Run 16, 18:03, Aug 6, 1989

Bond - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.8 m/s



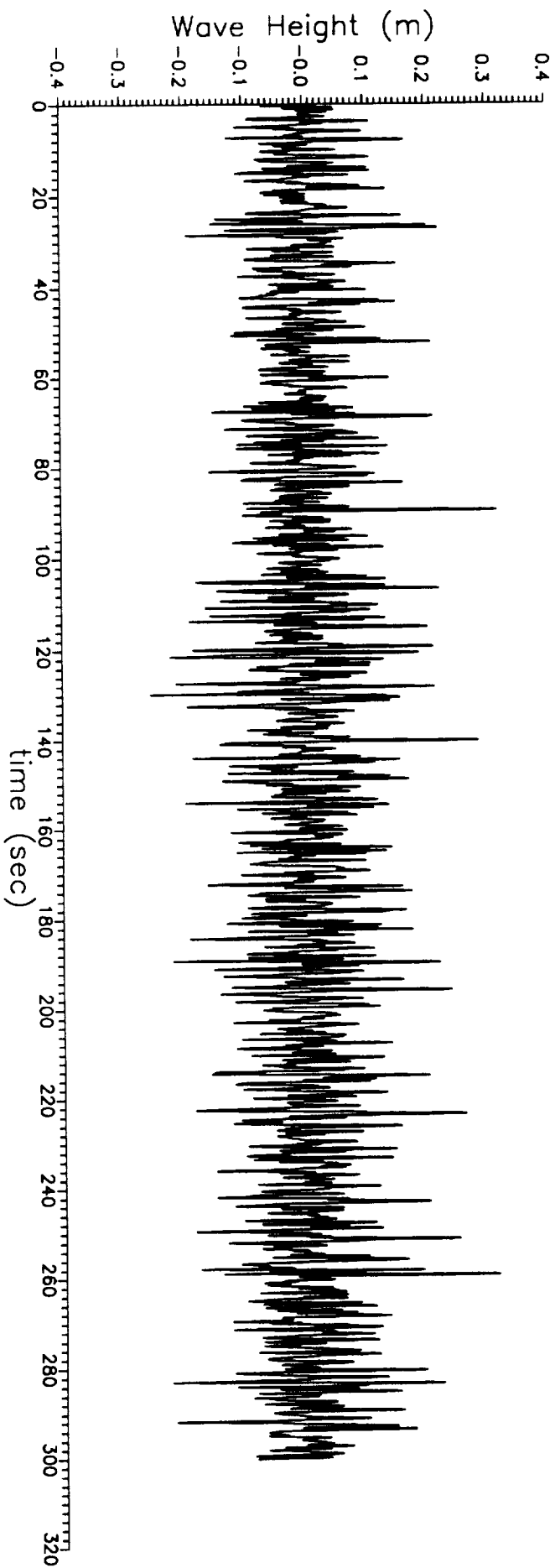
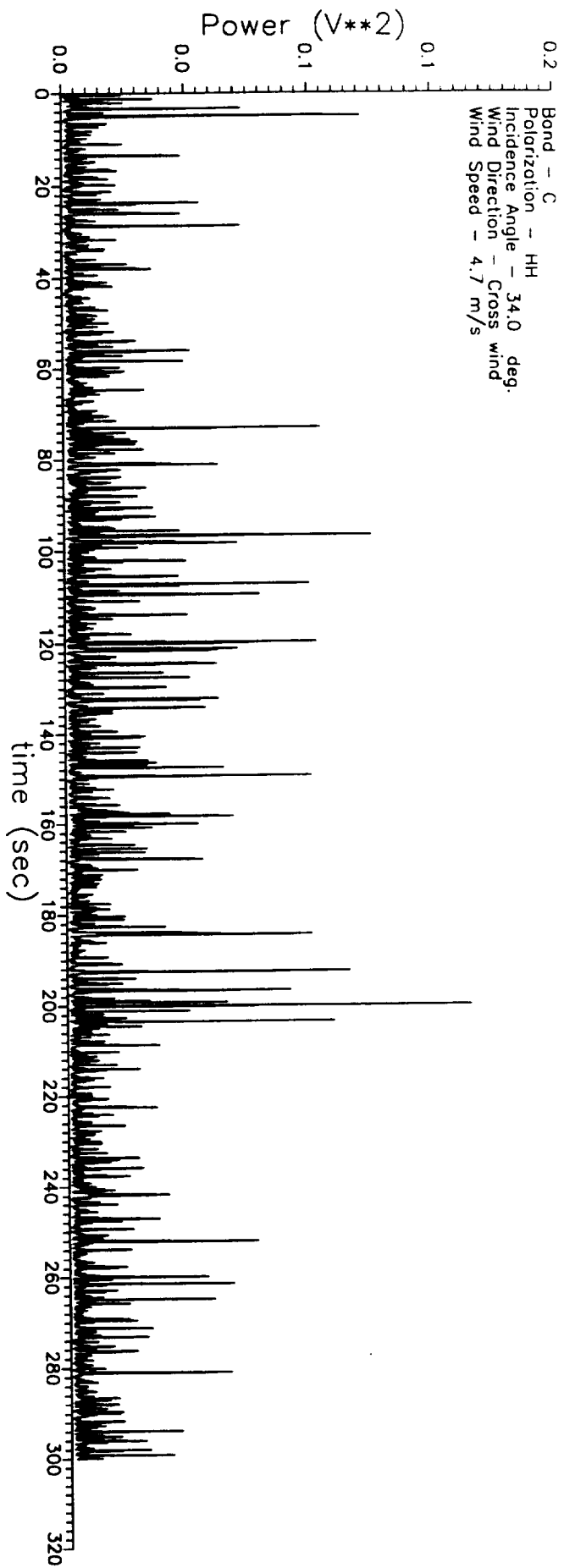
Run 17, 18:10, Aug 6, 1989

Band - C
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.7 m/s

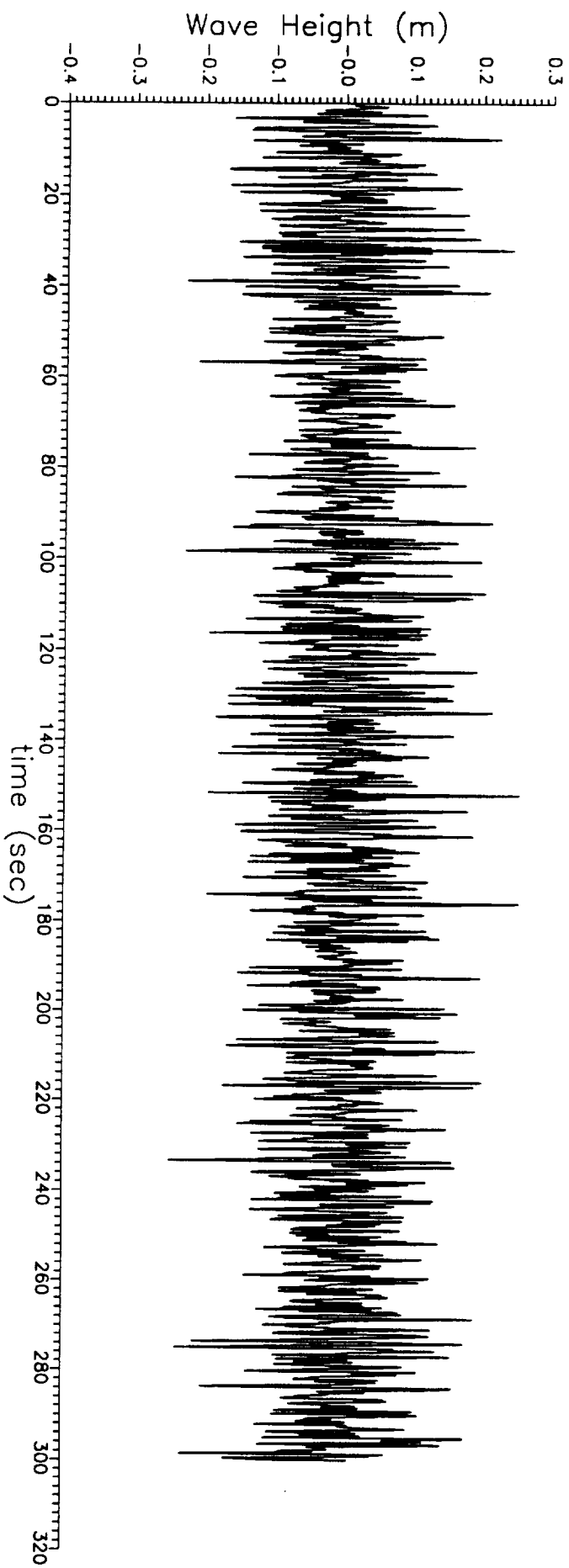
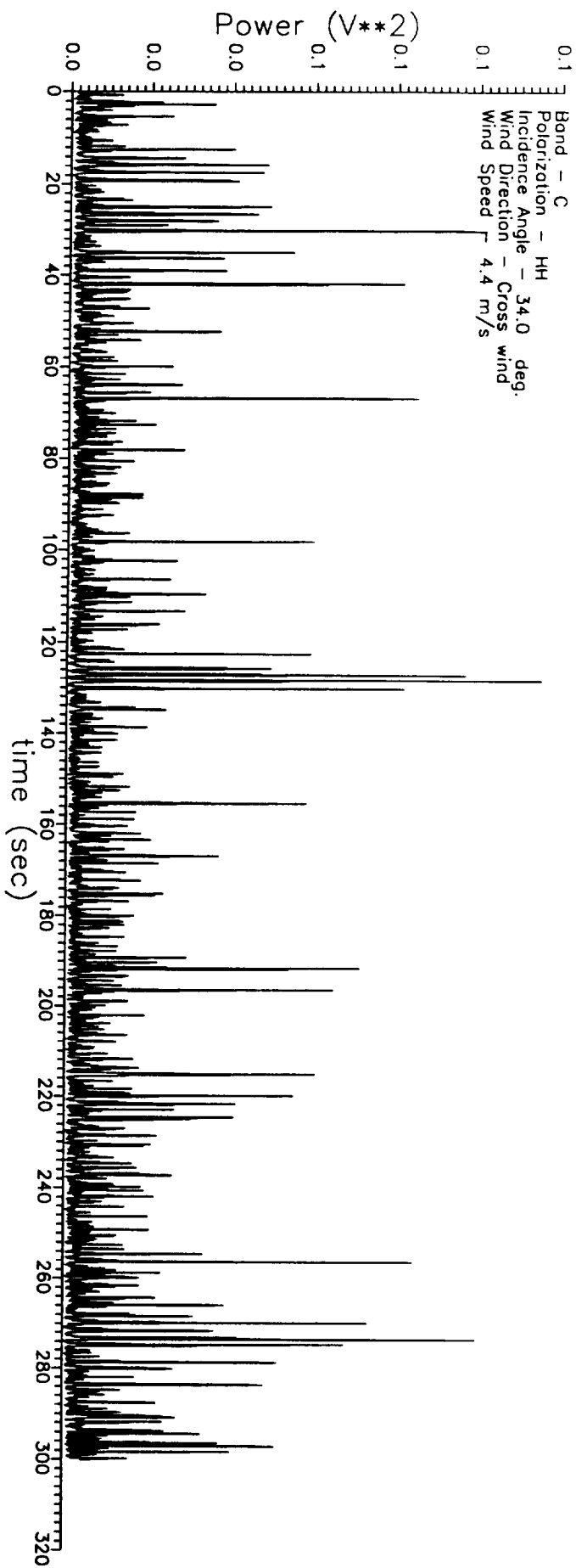


Run 18, 18:16, Aug 6, 1989

Bond - C
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.7 m/s

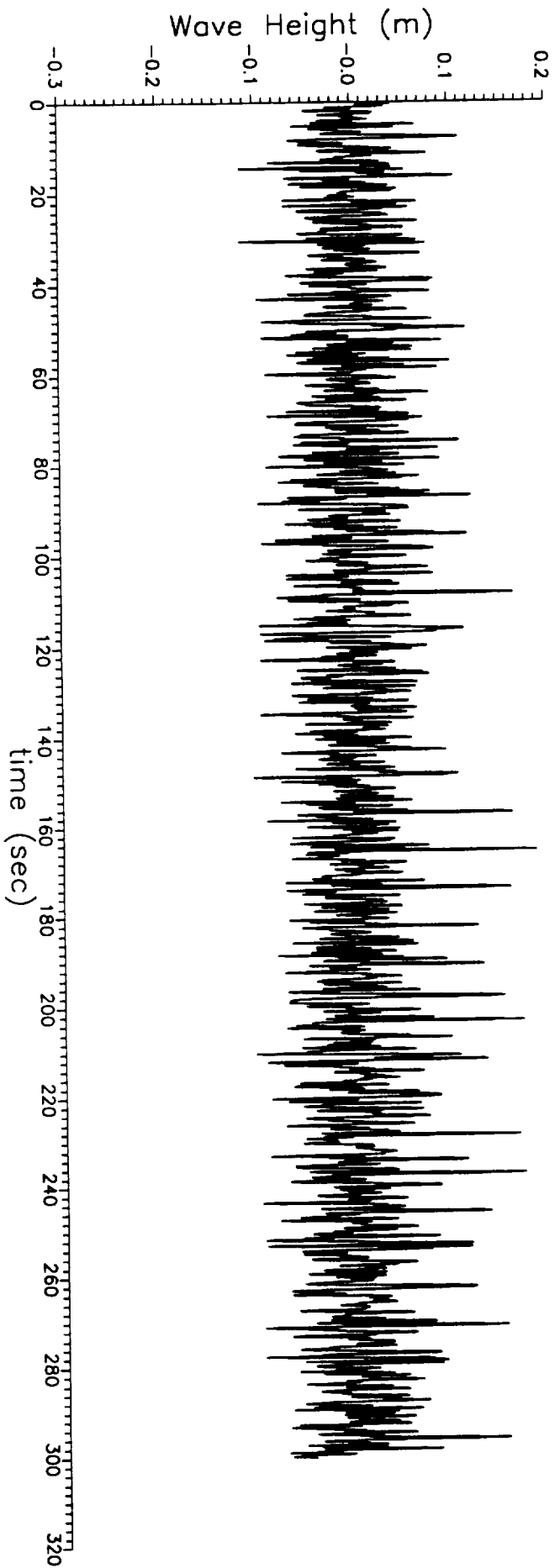
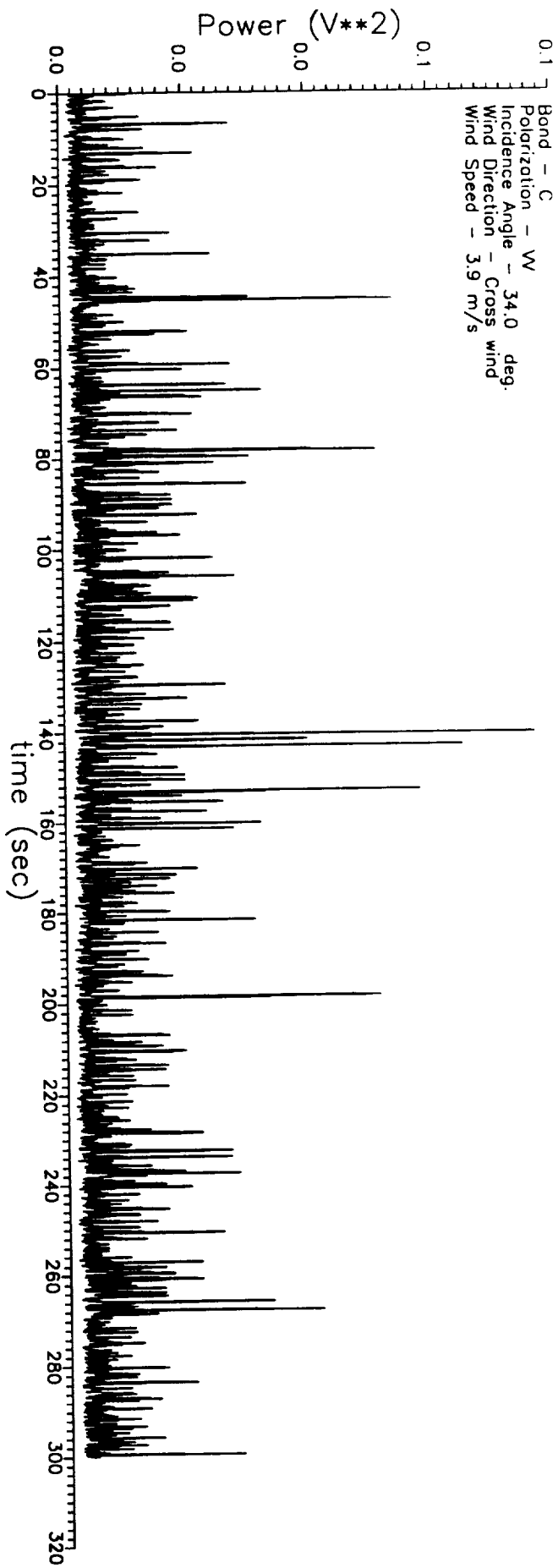


Run 19, 18:21, Aug 6, 1989



Run 5, 15:15, Aug 7, 1989

Bond - C
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 3.9 m/s



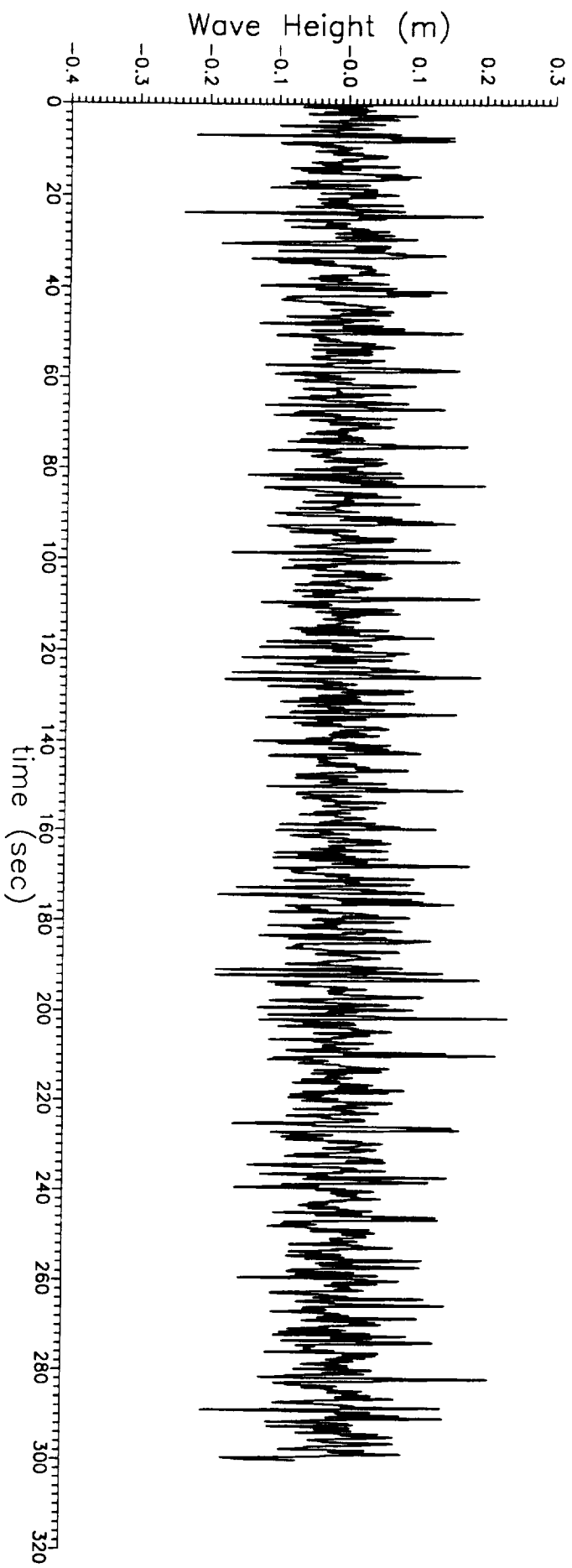
Power (V**2)

0.1
0.1
0.0
0.0
0.0

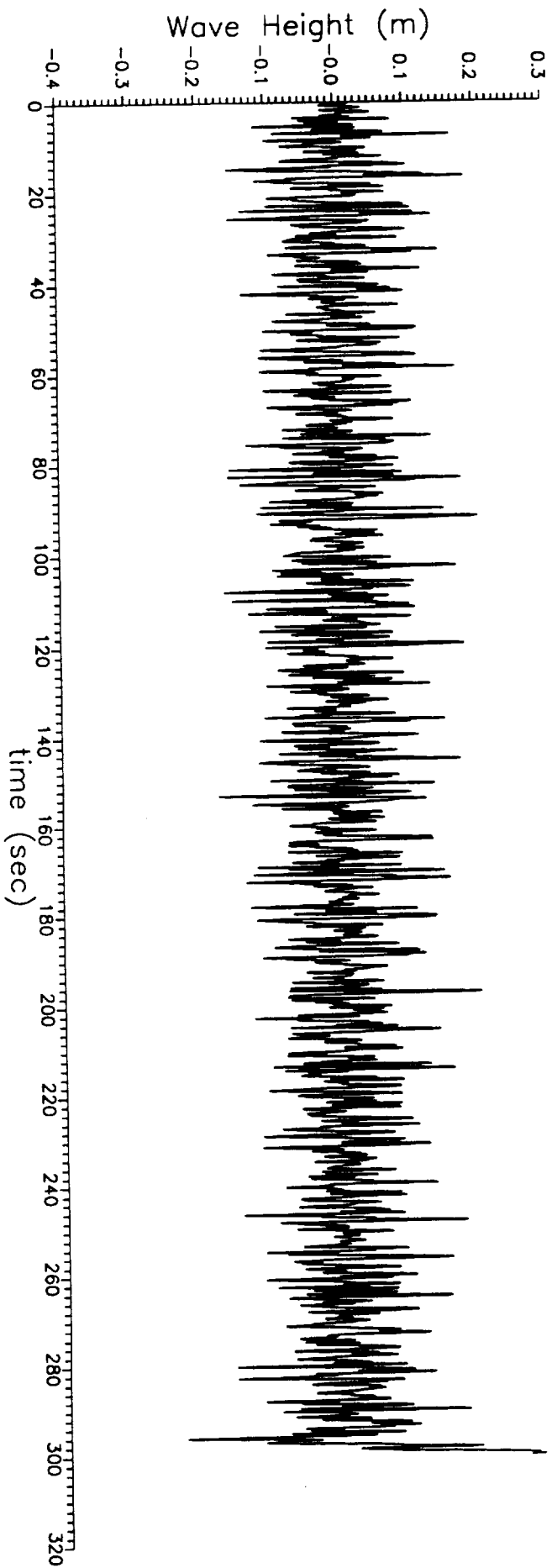
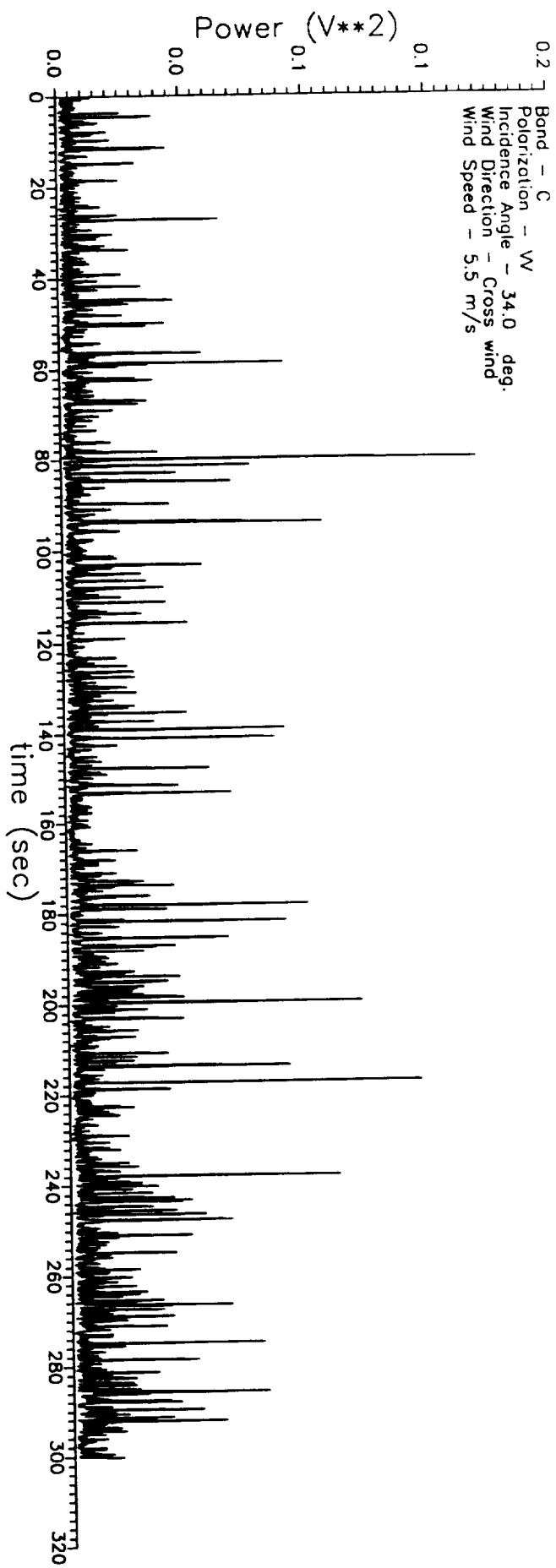
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320

time (sec)

Bond - C
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 6.3 m/s

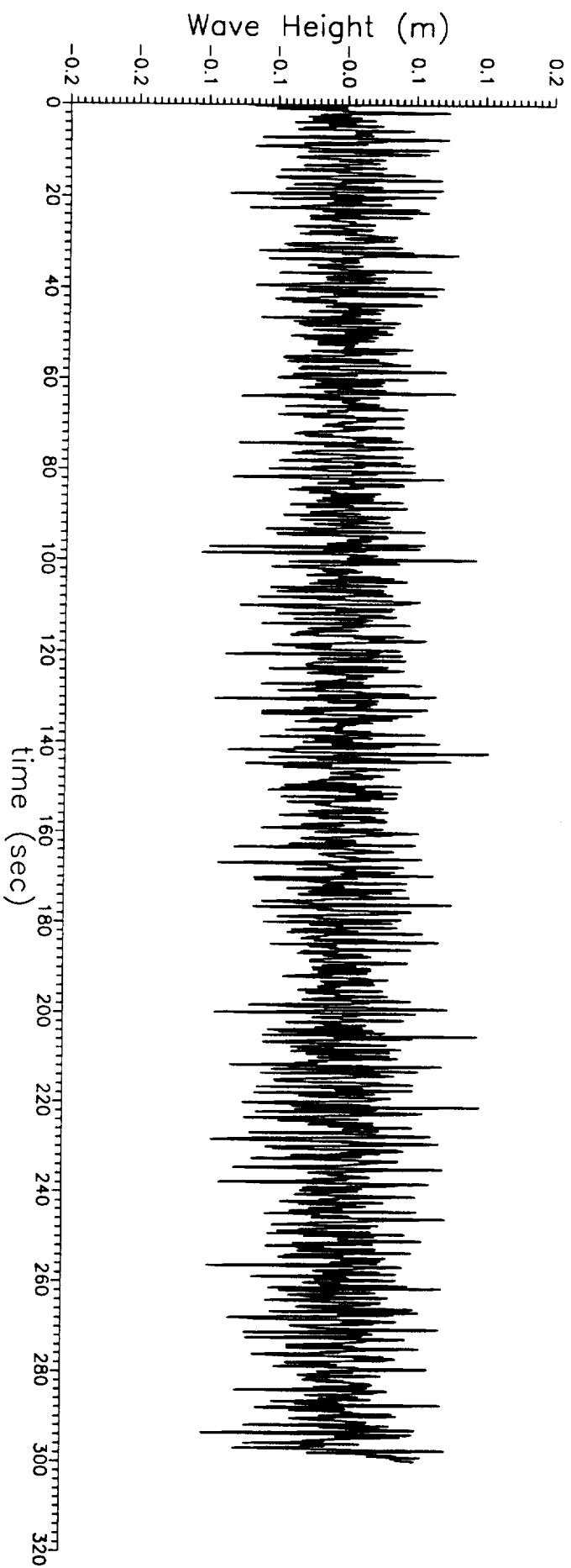
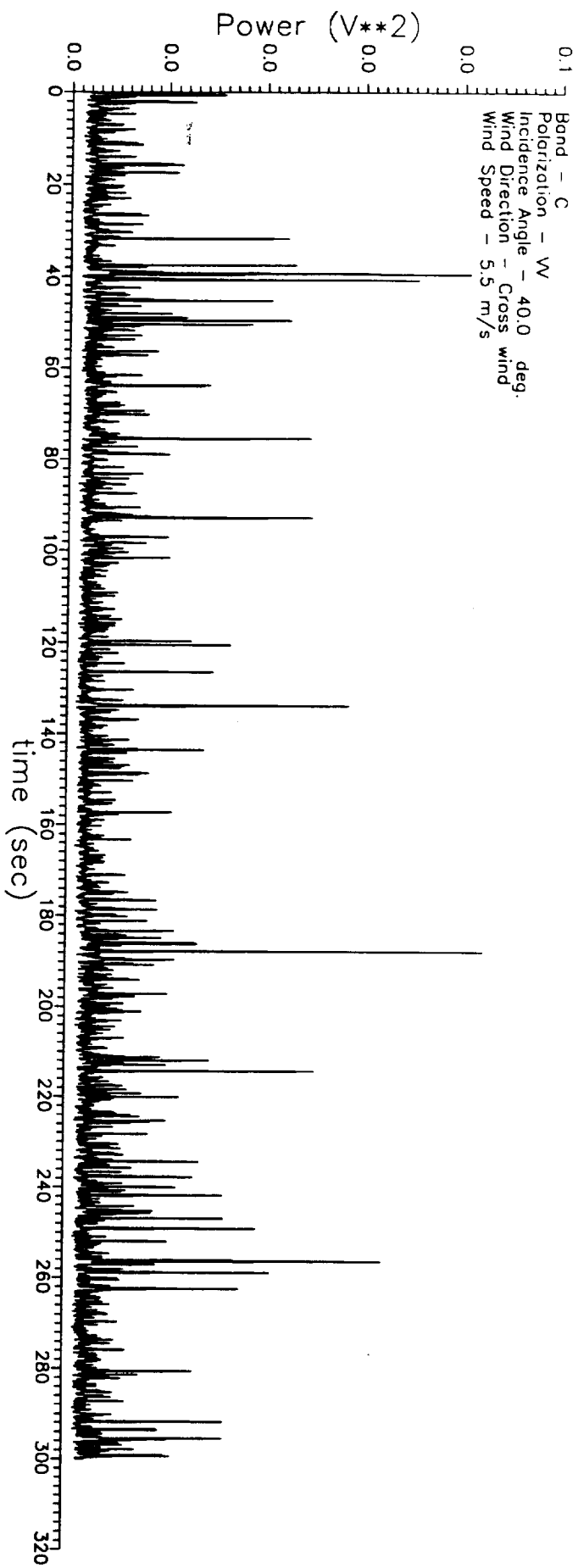


Run 9, 17:45, Aug 7, 1989

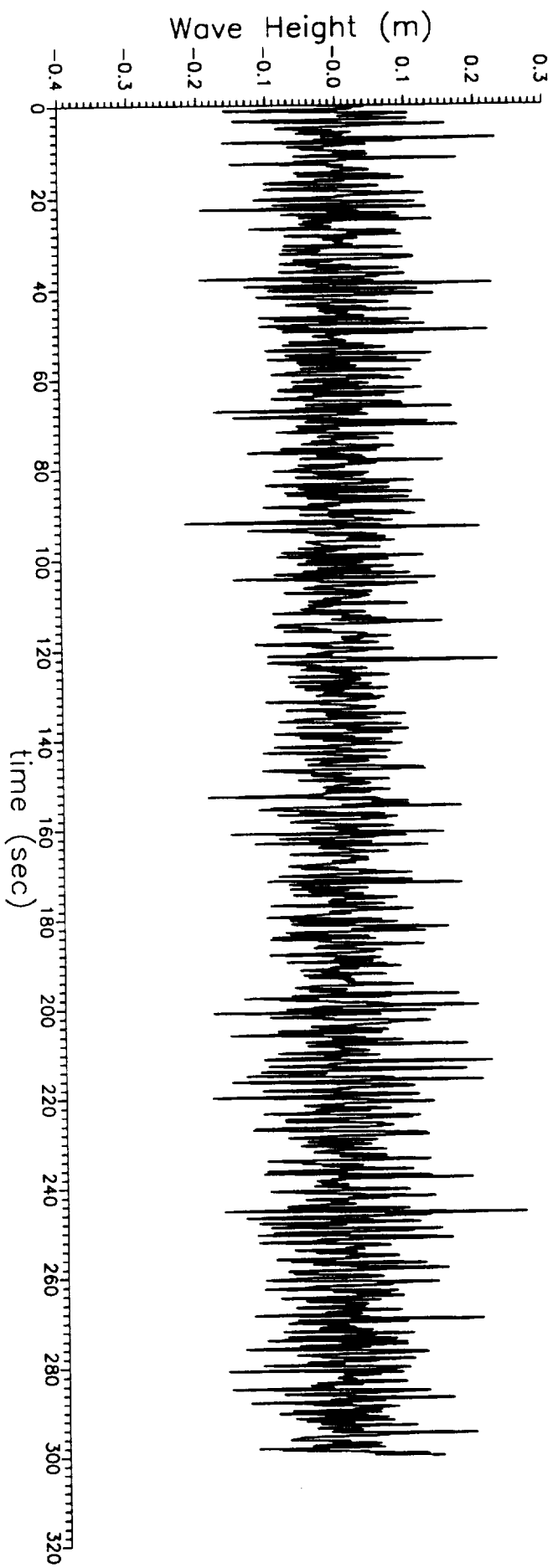
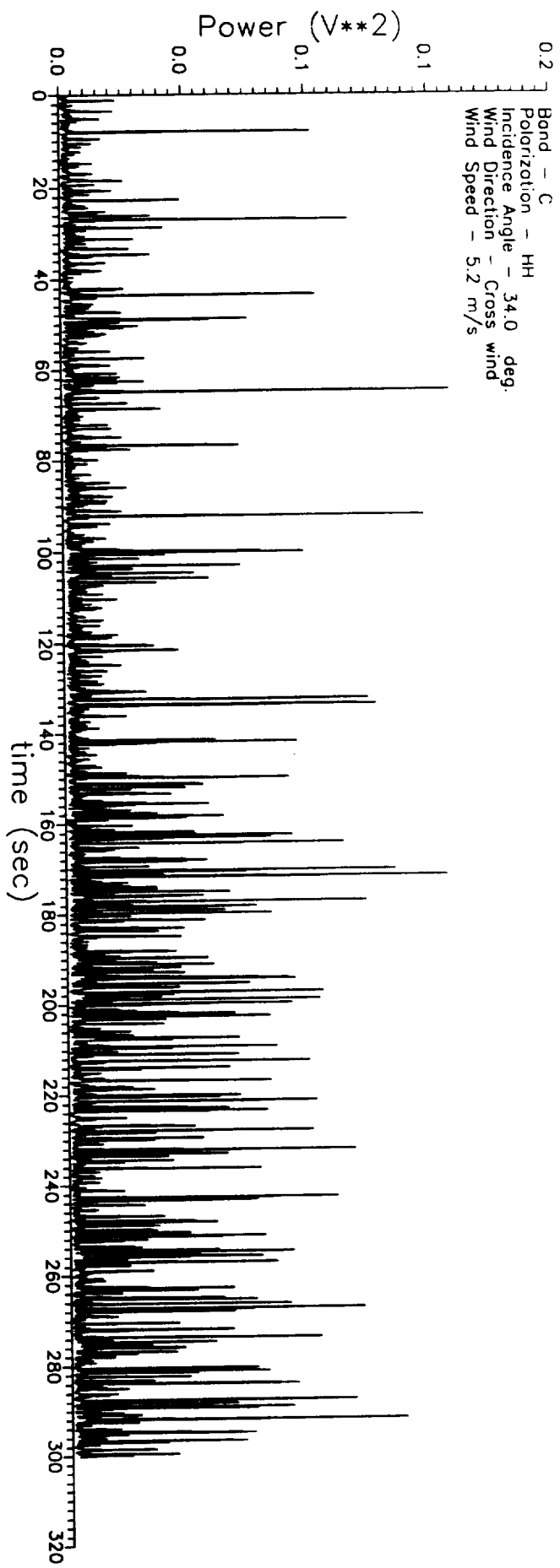


Run 10, 17:52, Aug 7, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.5 m/s

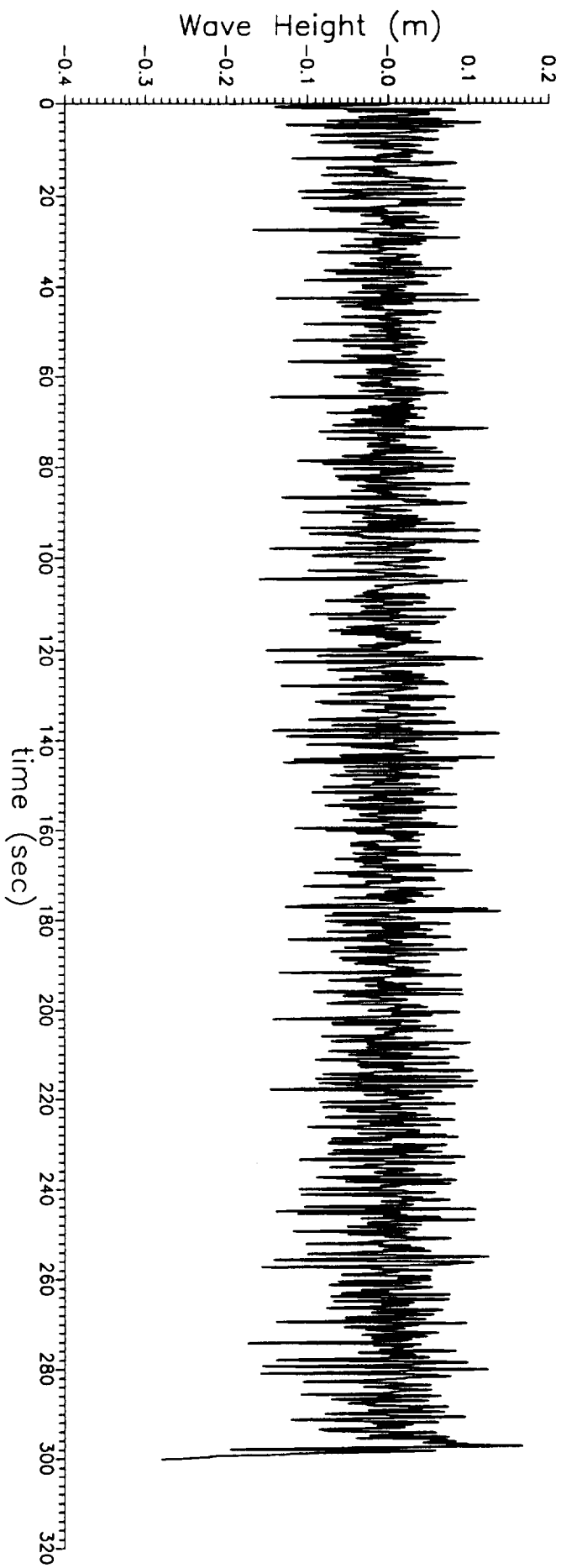
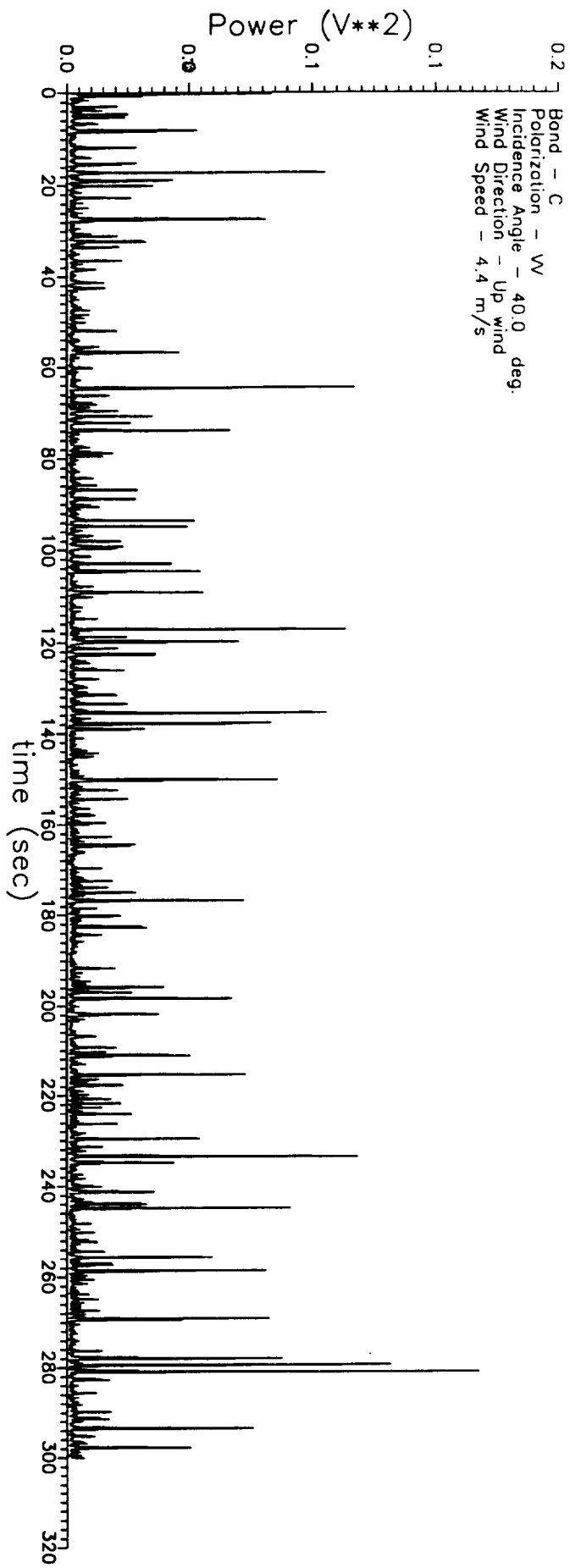


Run 11, 17:59, Aug 7, 1989



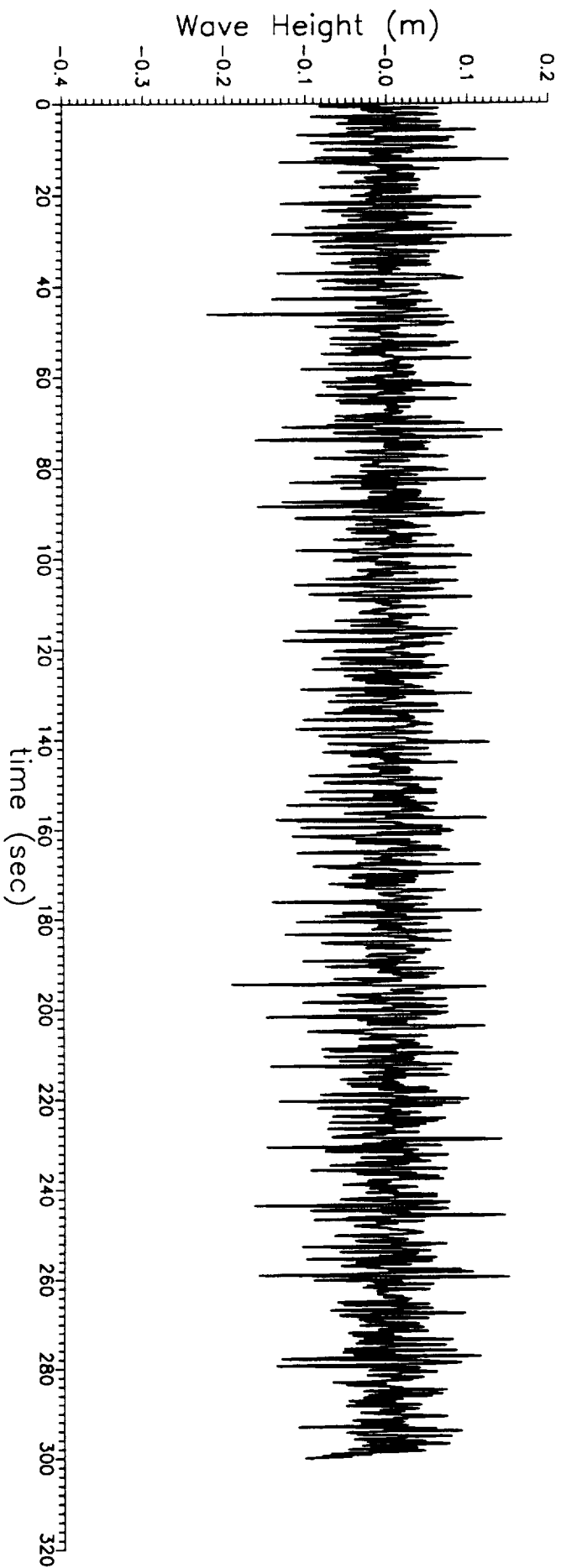
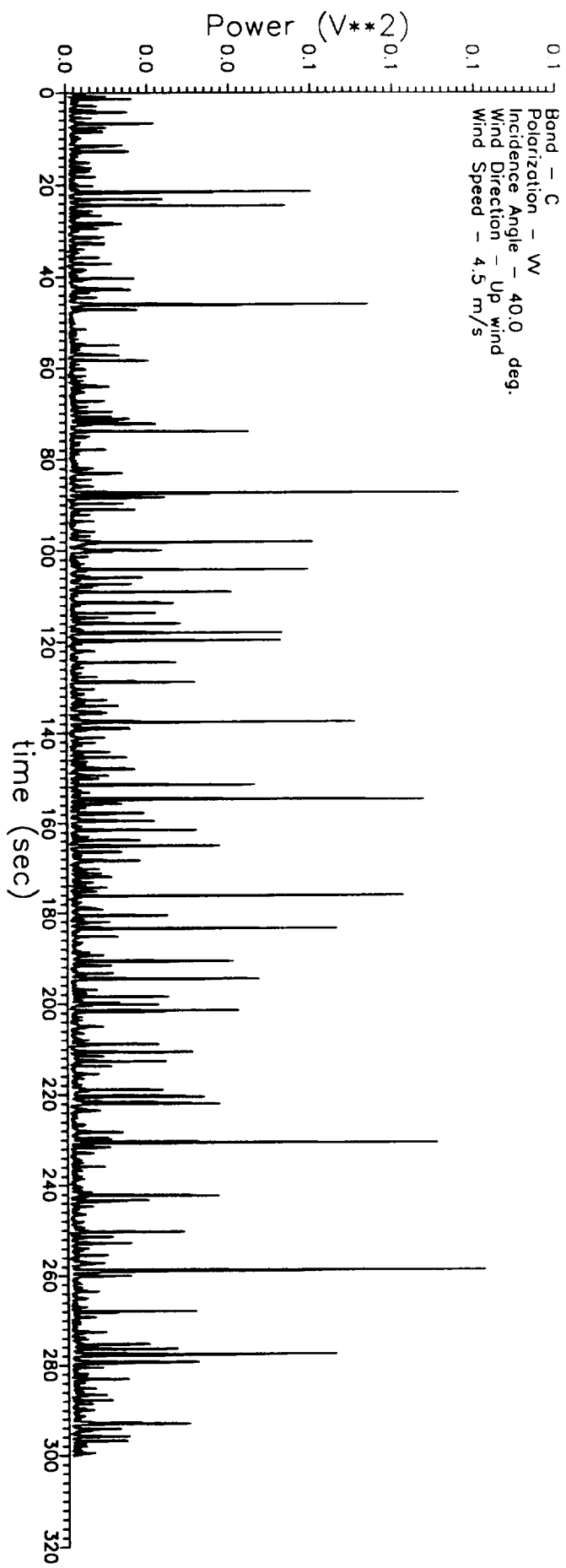
Run 12, 18:34, Aug 7, 1989

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s



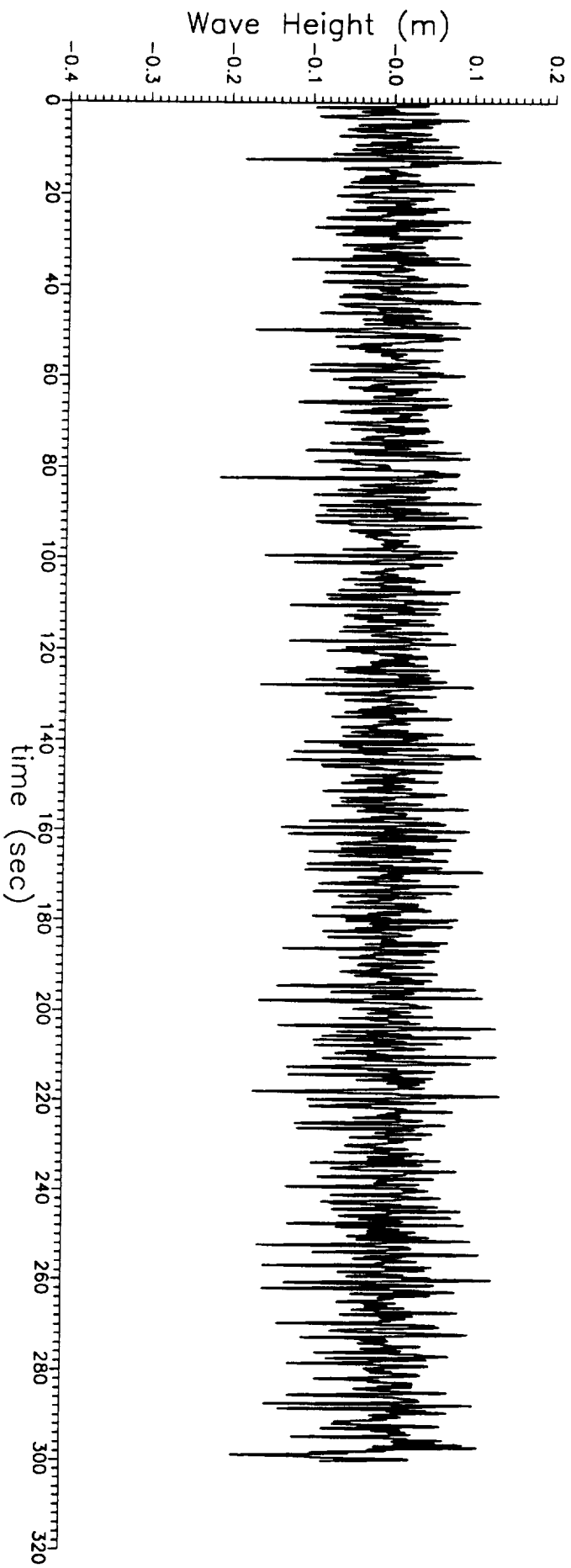
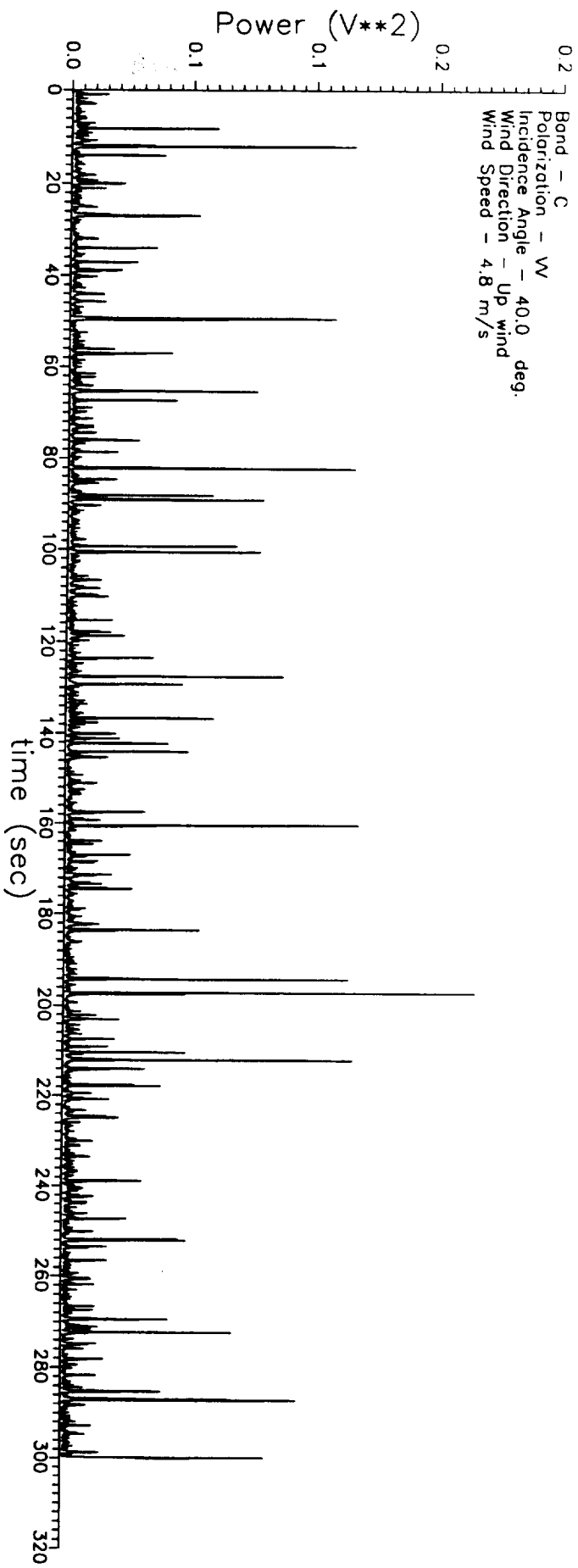
Run 13, 18:39, Aug 7, 1989

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.5 m/s

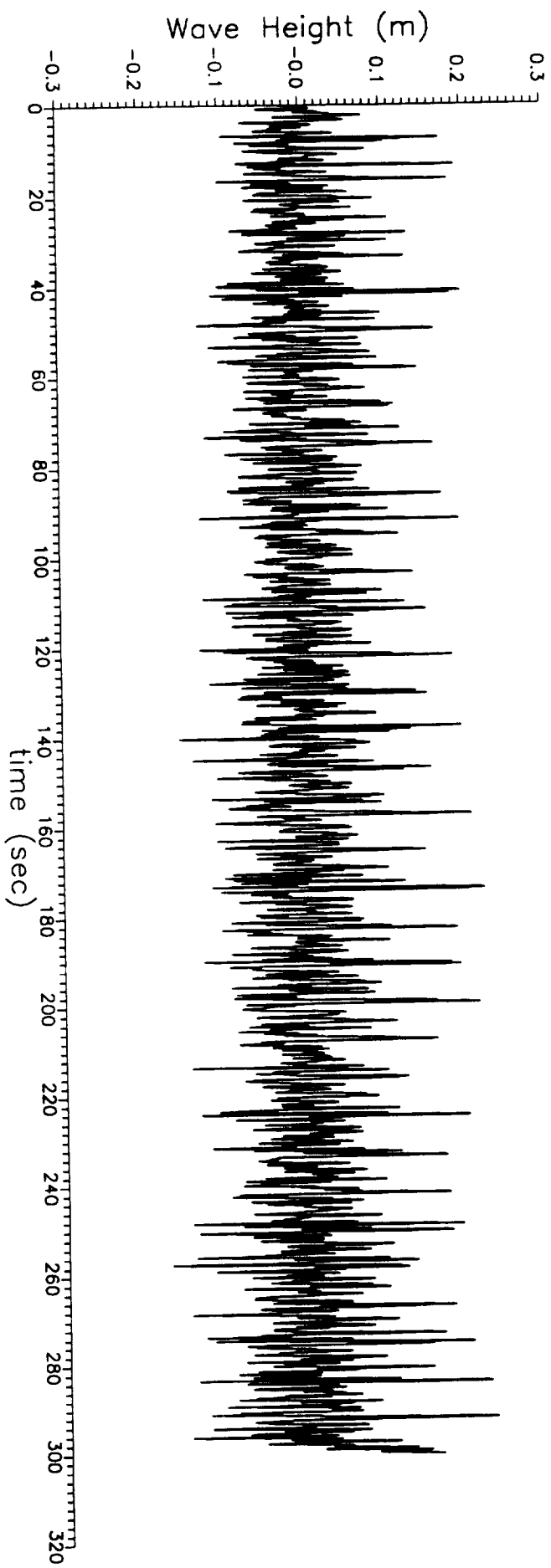
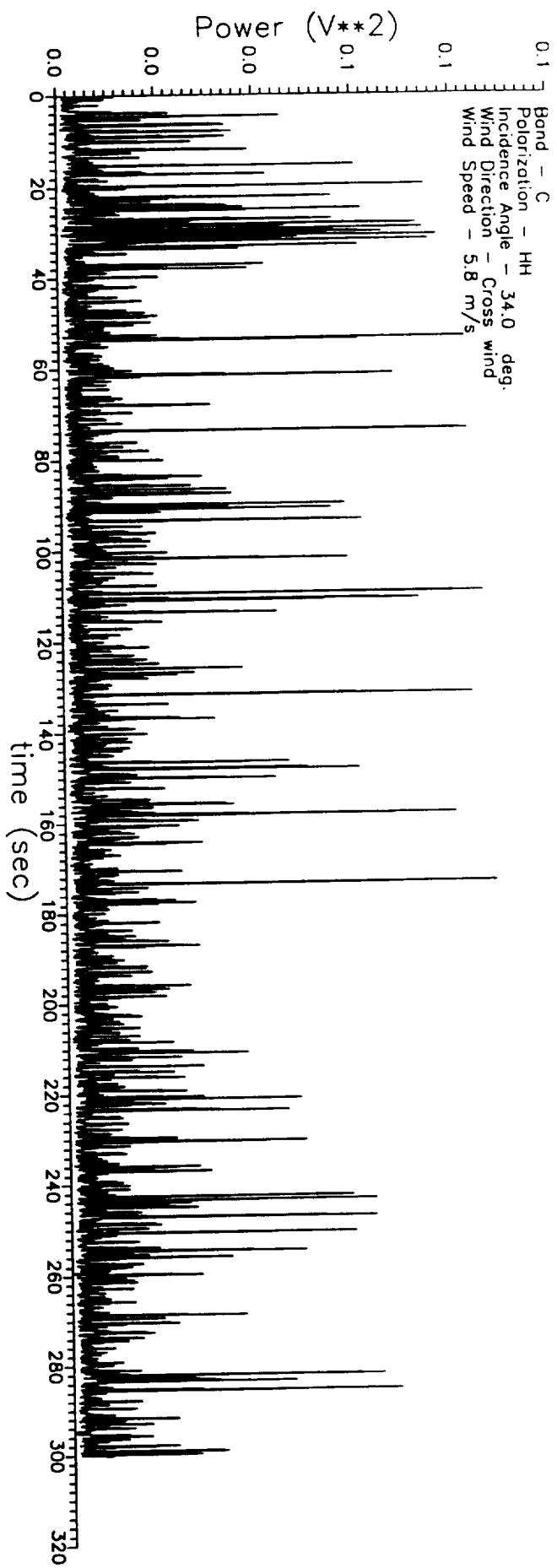


Run 14, 18:45, Aug 7, 1989

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s

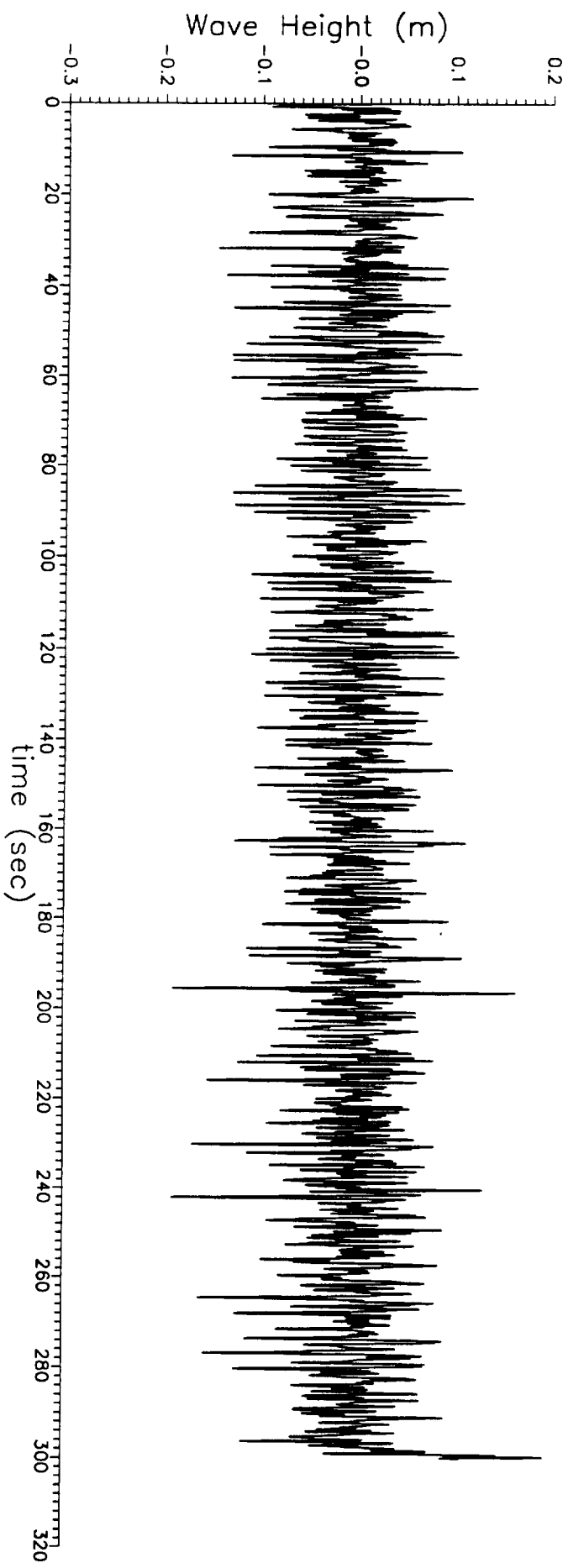
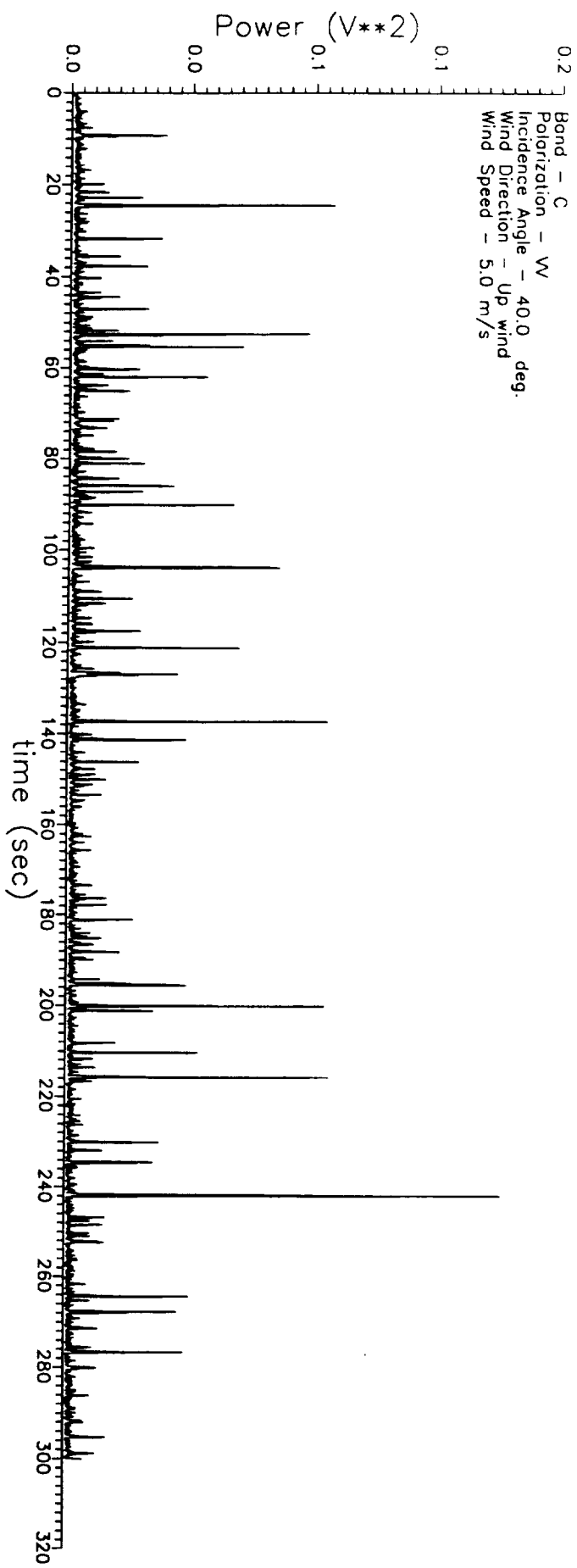


Run 15, 18:53, Aug 7, 1989



Run 16, 19:15, Aug 7, 1989

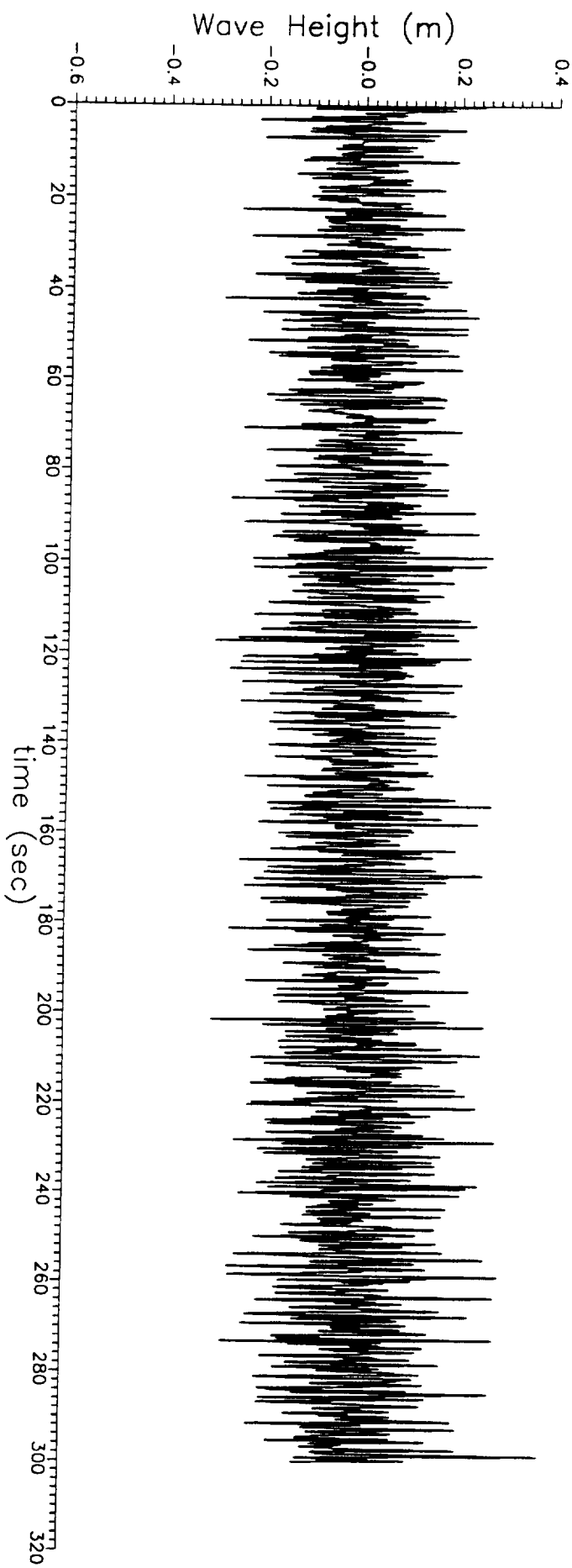
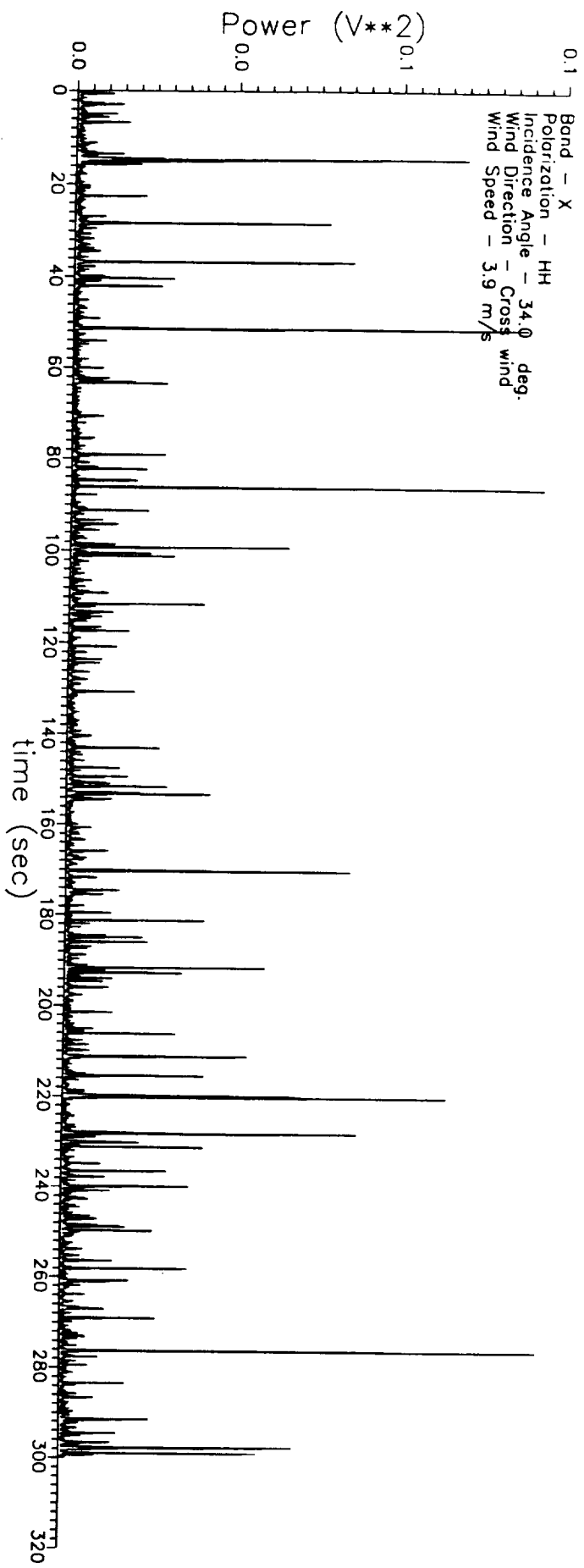
Band - C
Polarization - VV
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.0 m/s



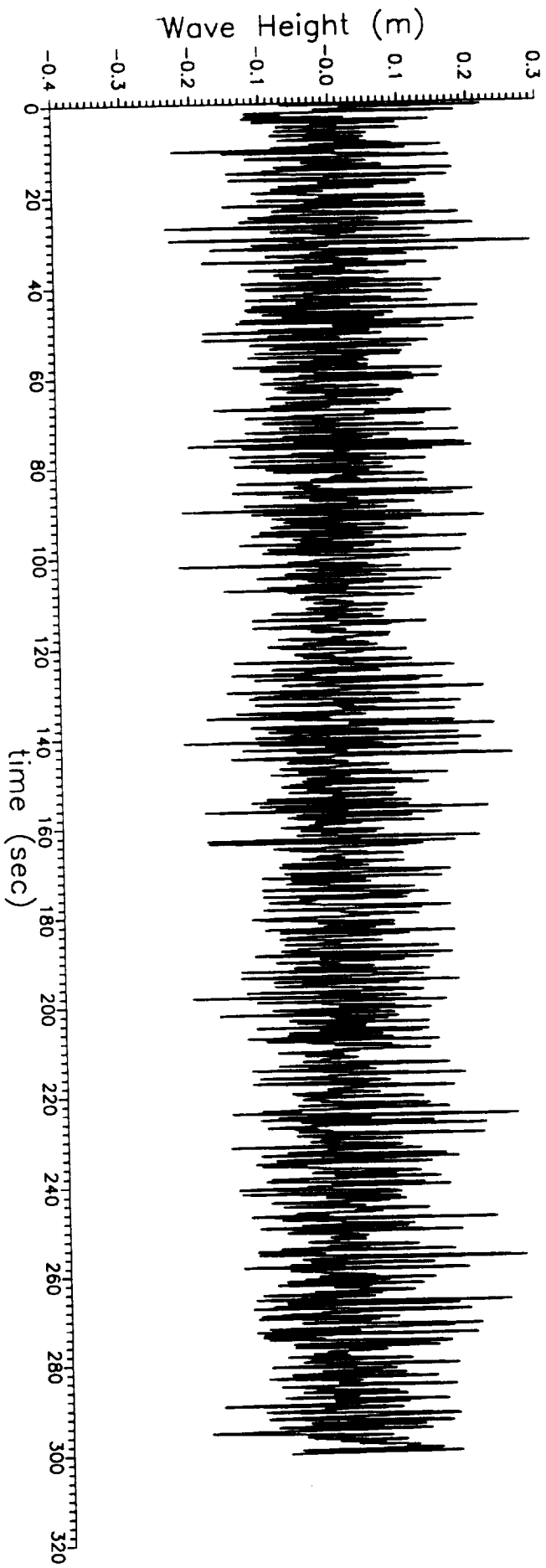
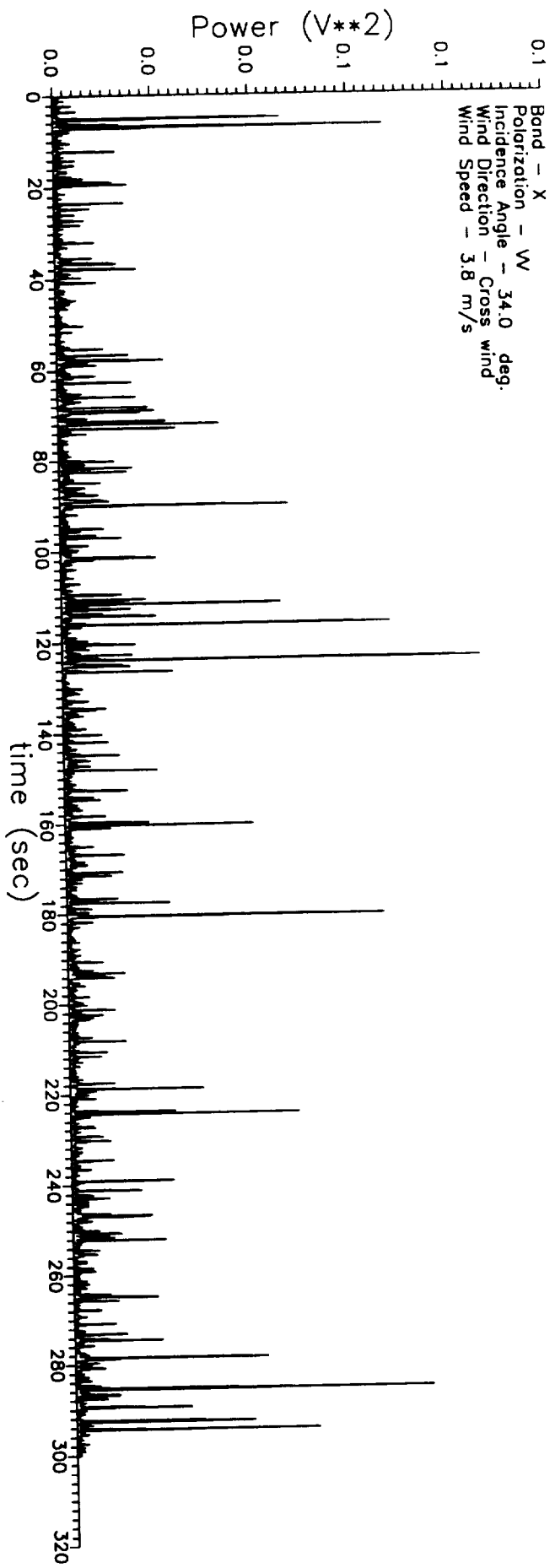
A-2. X Band

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
84

Run 1, 11:45, July 12, 1989

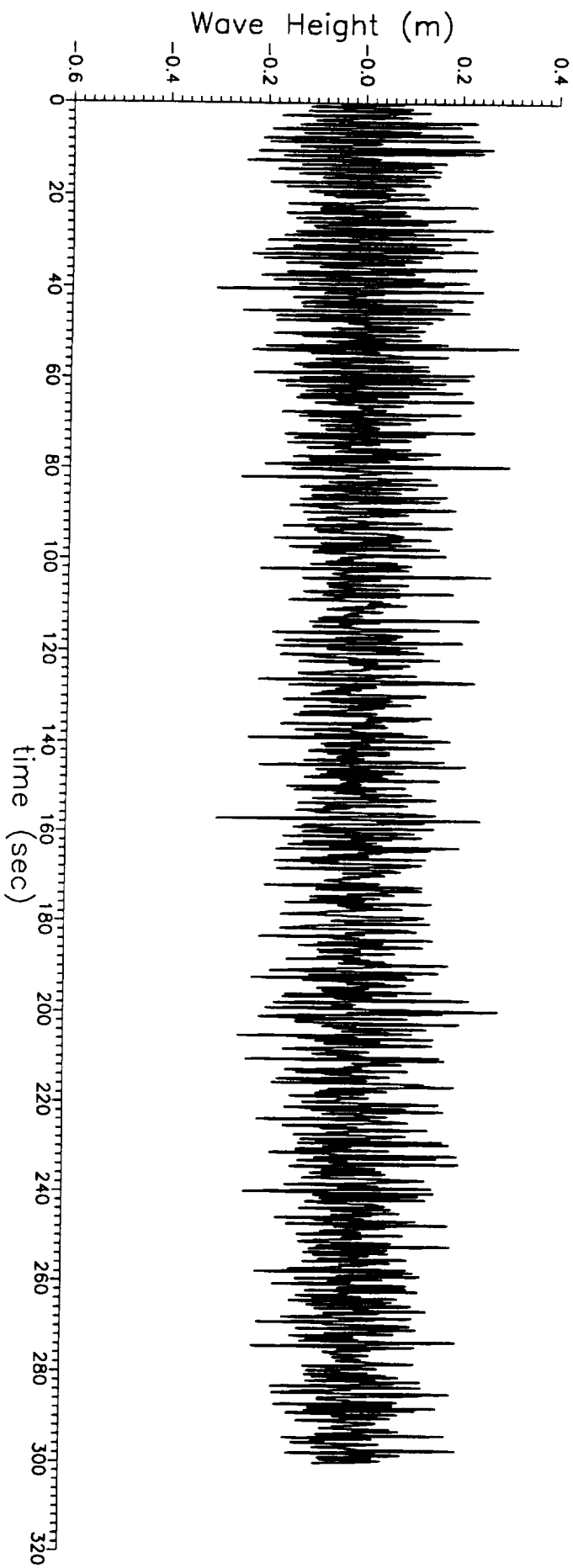
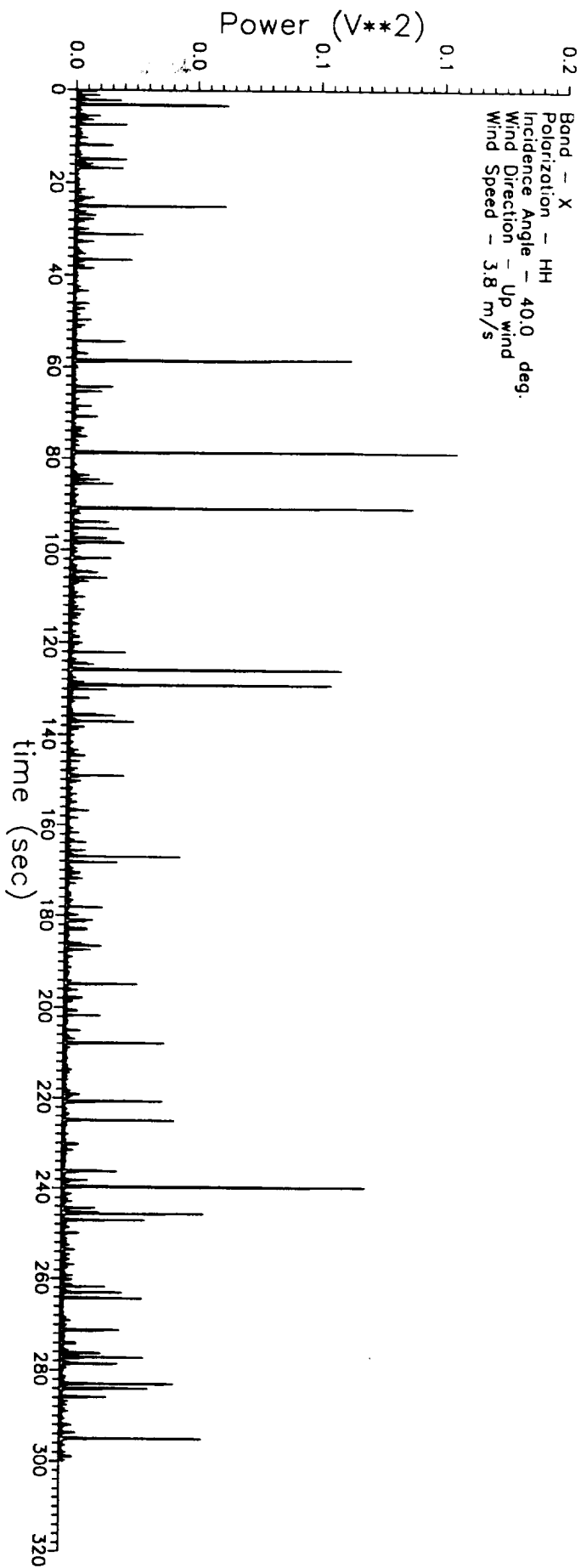


Run 2, 11:55, July 12, 1989



Run 16, 15:03, July 12, 1989

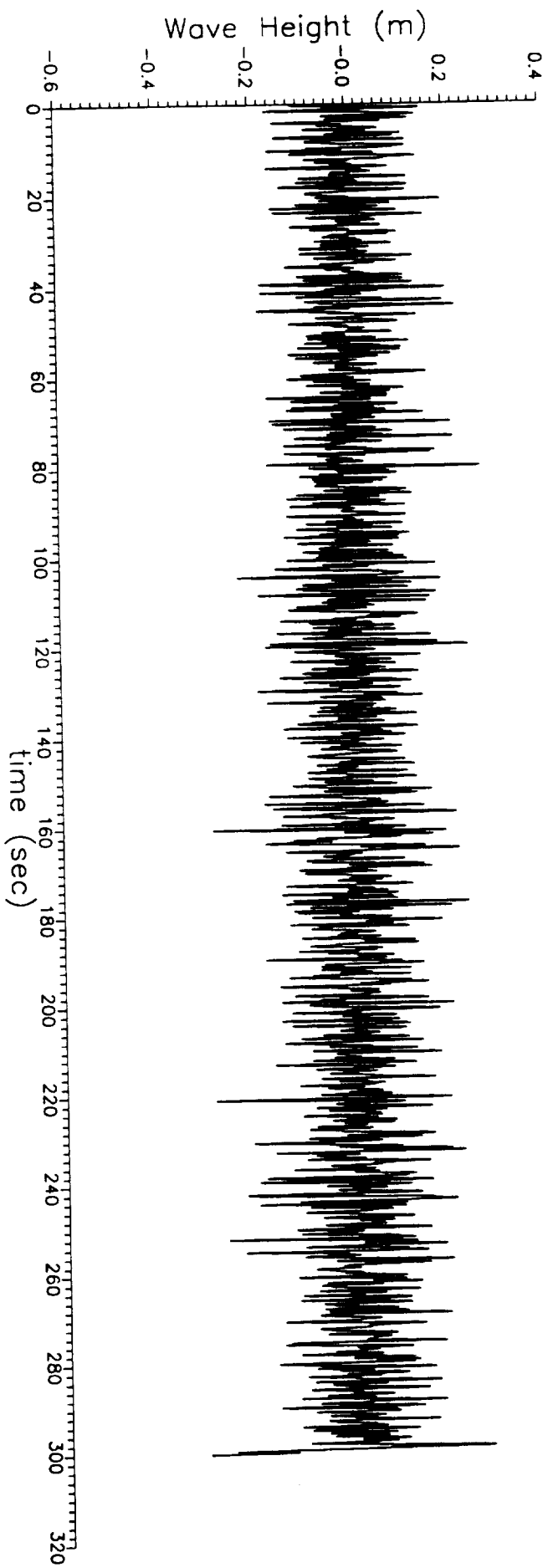
Band - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 3.8 m/s



Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 2.8 m/s

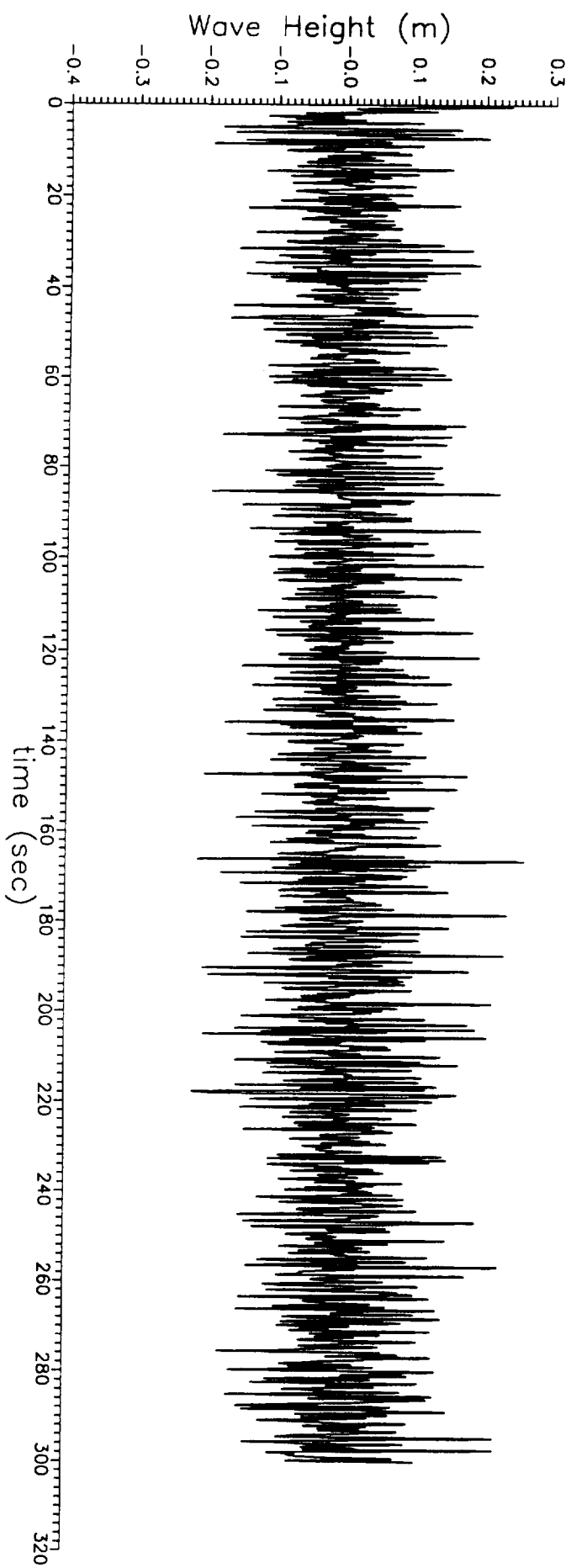
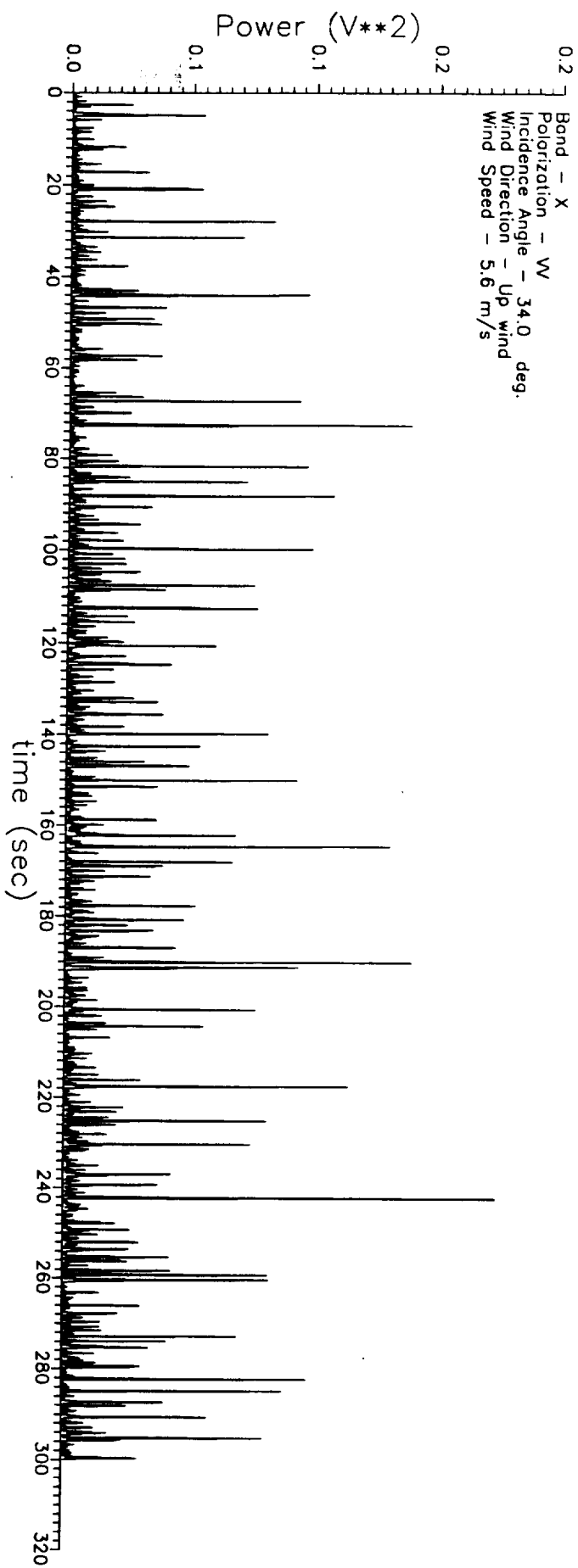
Power (V**2)

time (sec)

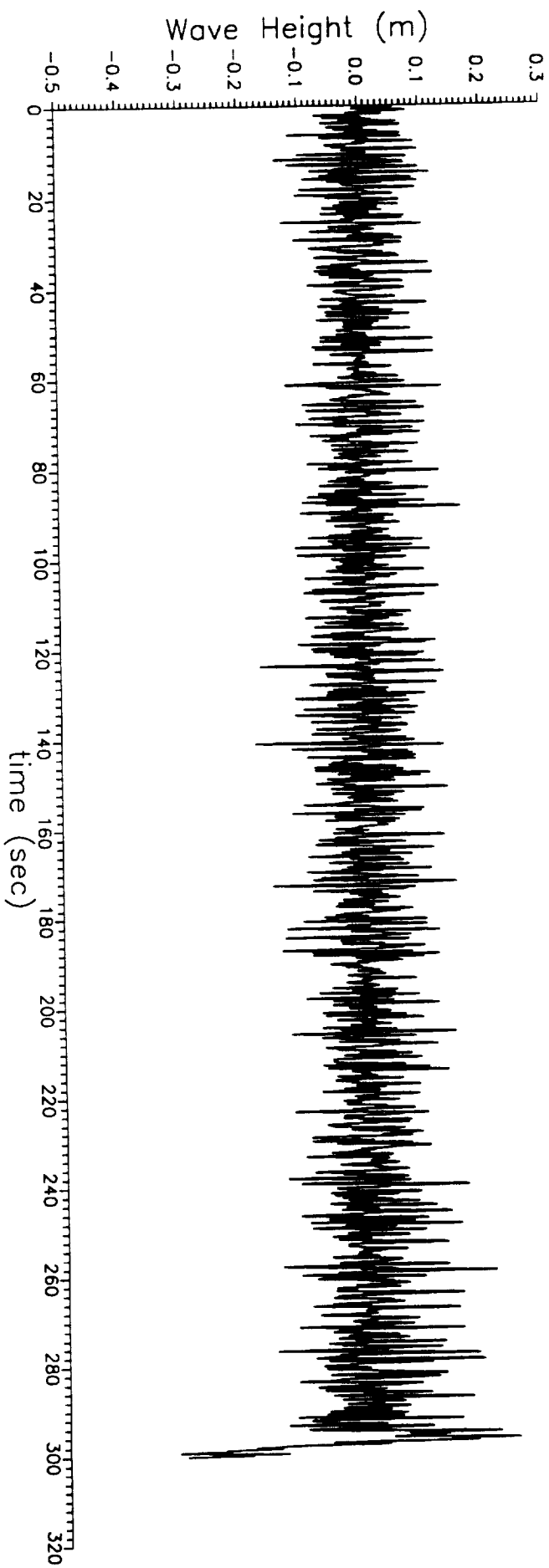
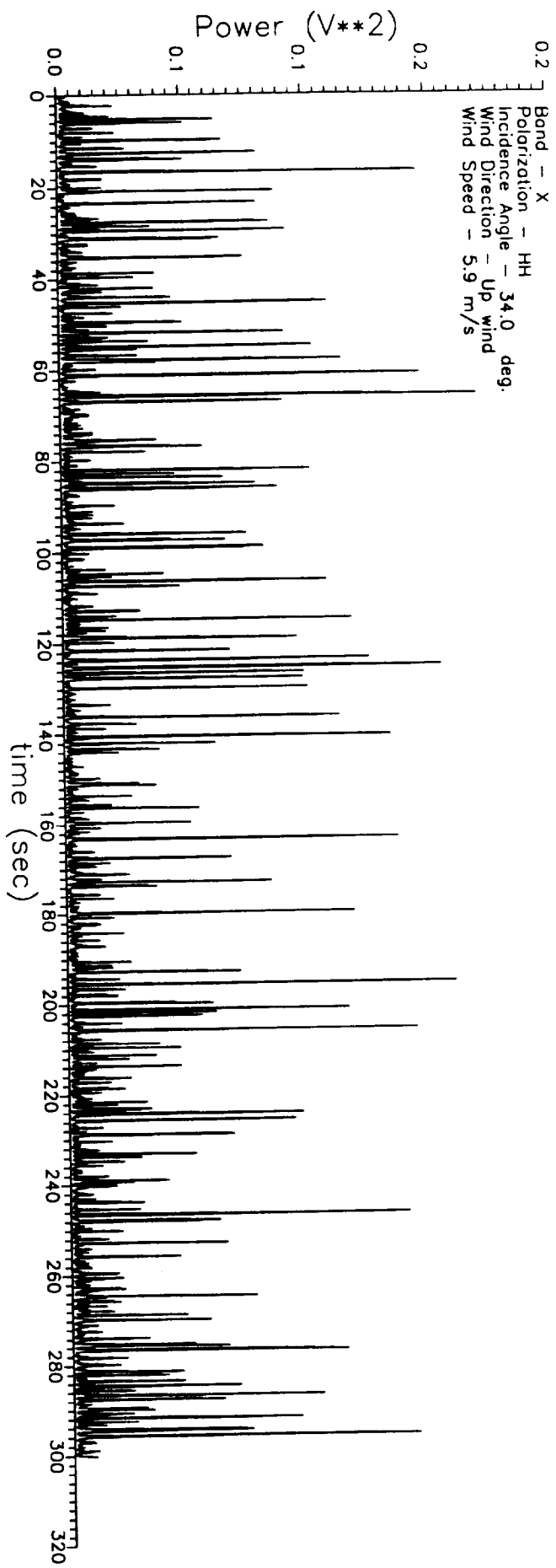


Run 6, 17:05, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 5.6 m/s

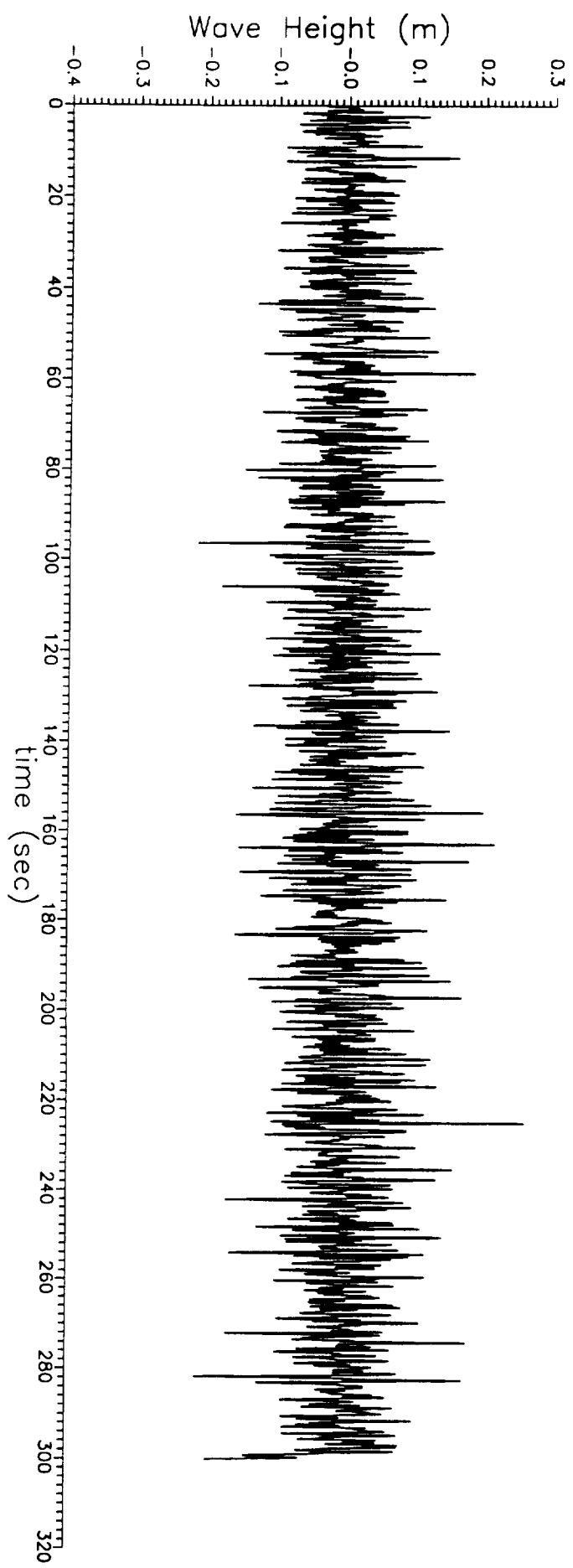
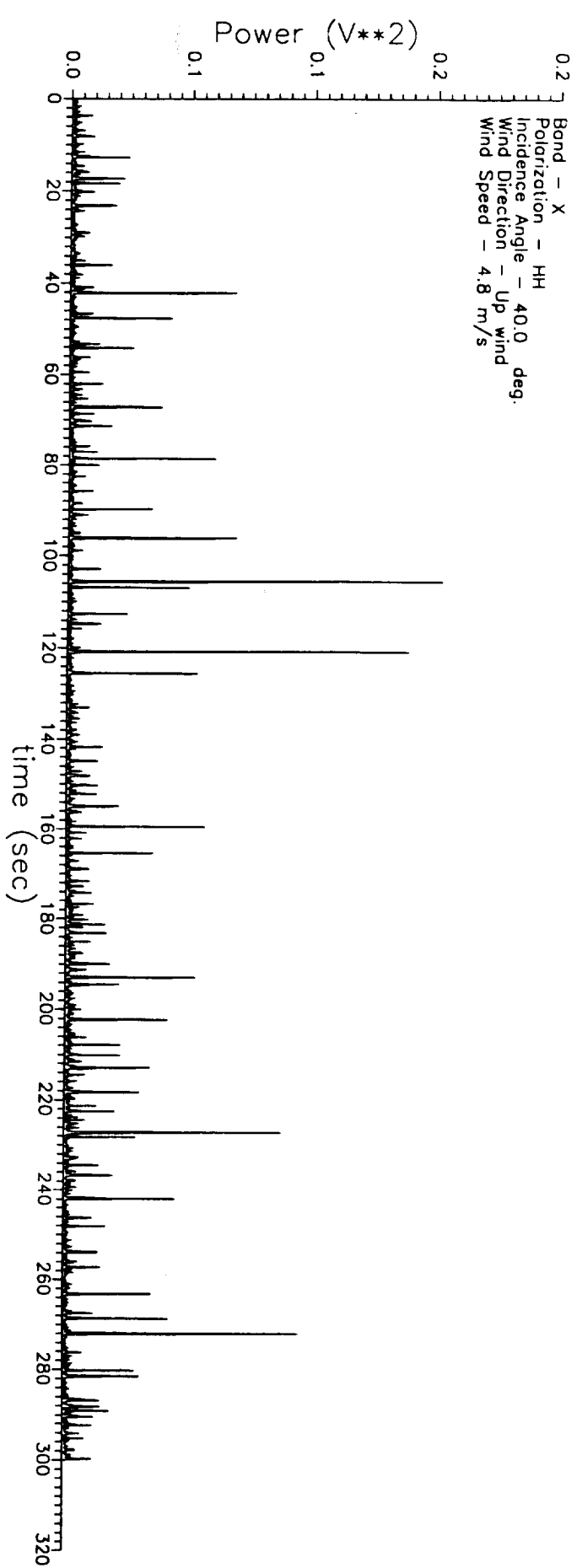


Run 7, 17:13, July 19, 1989

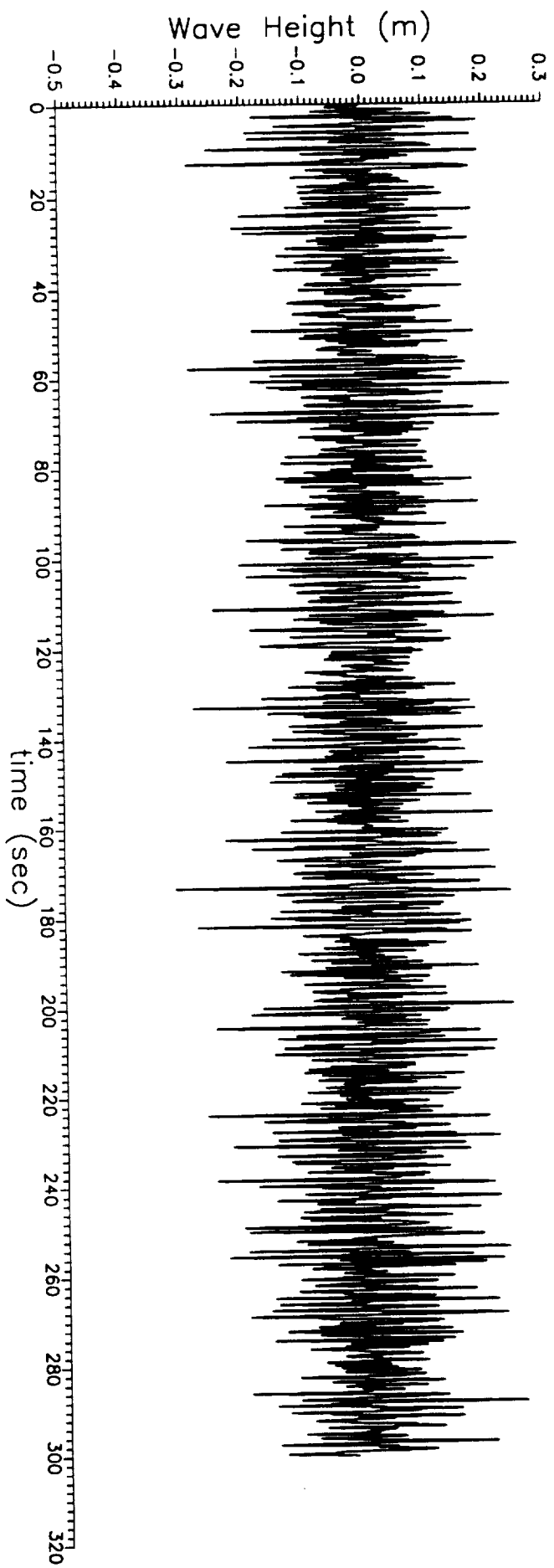
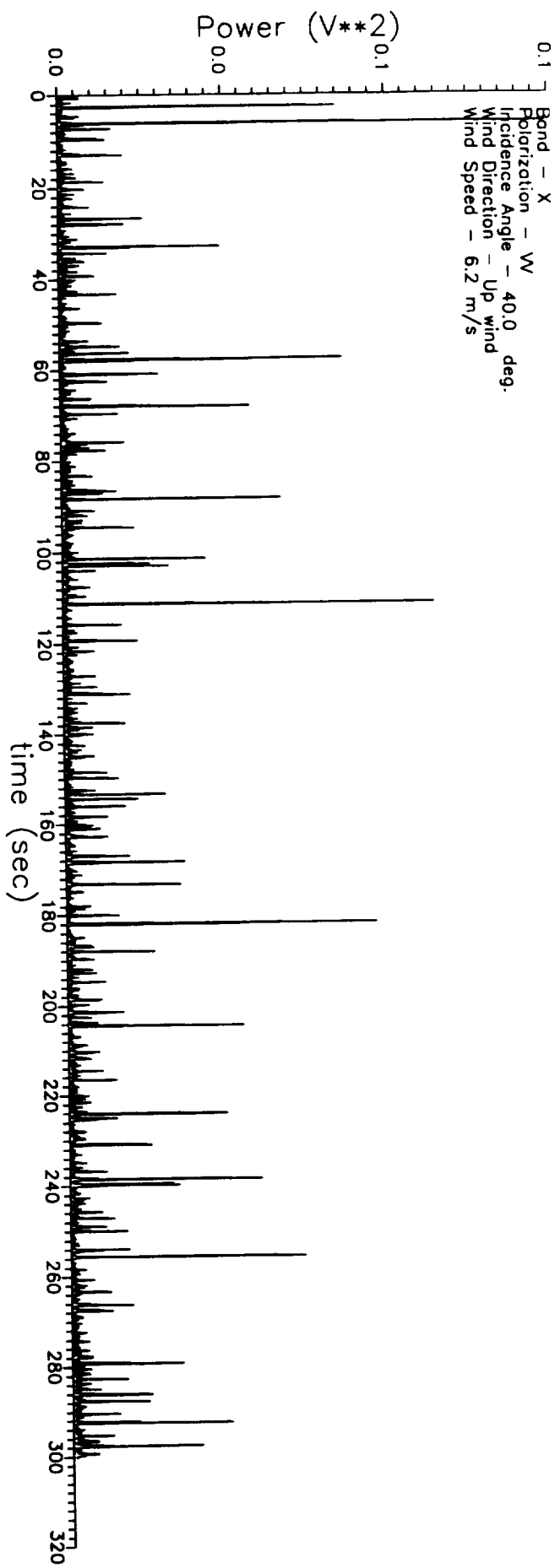


Run 8, 17:19, July 19, 1989

Bond - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s

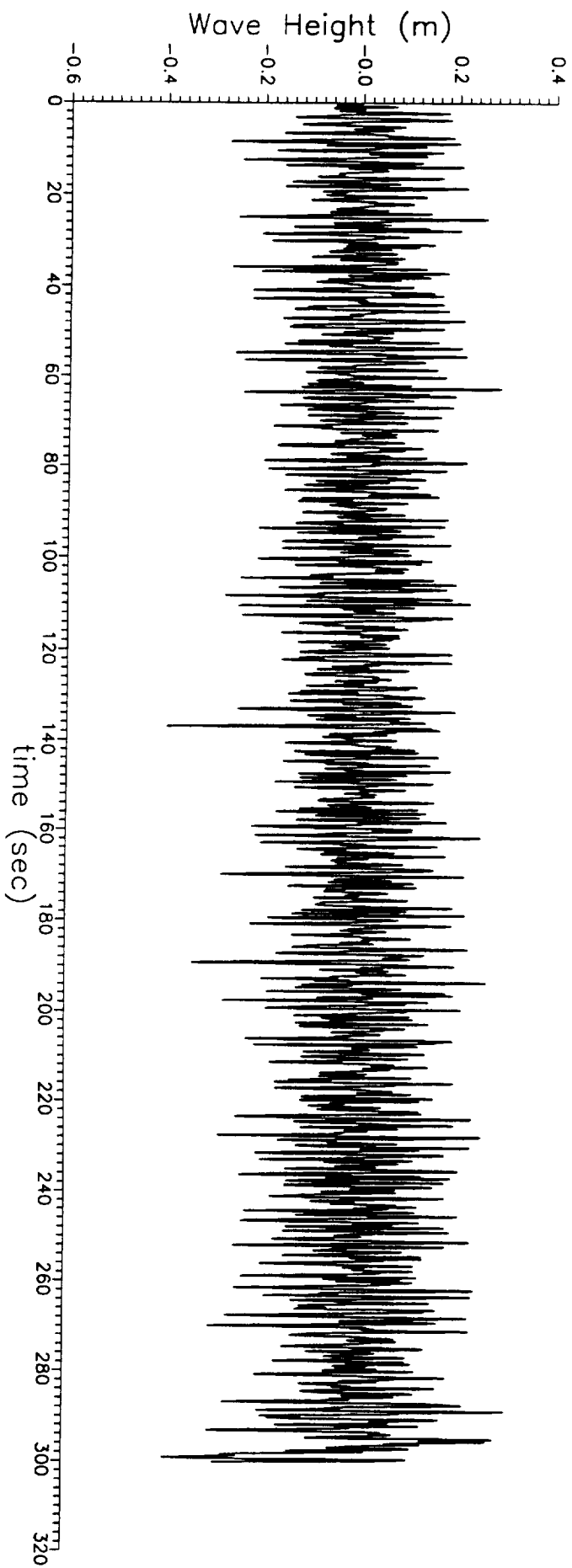
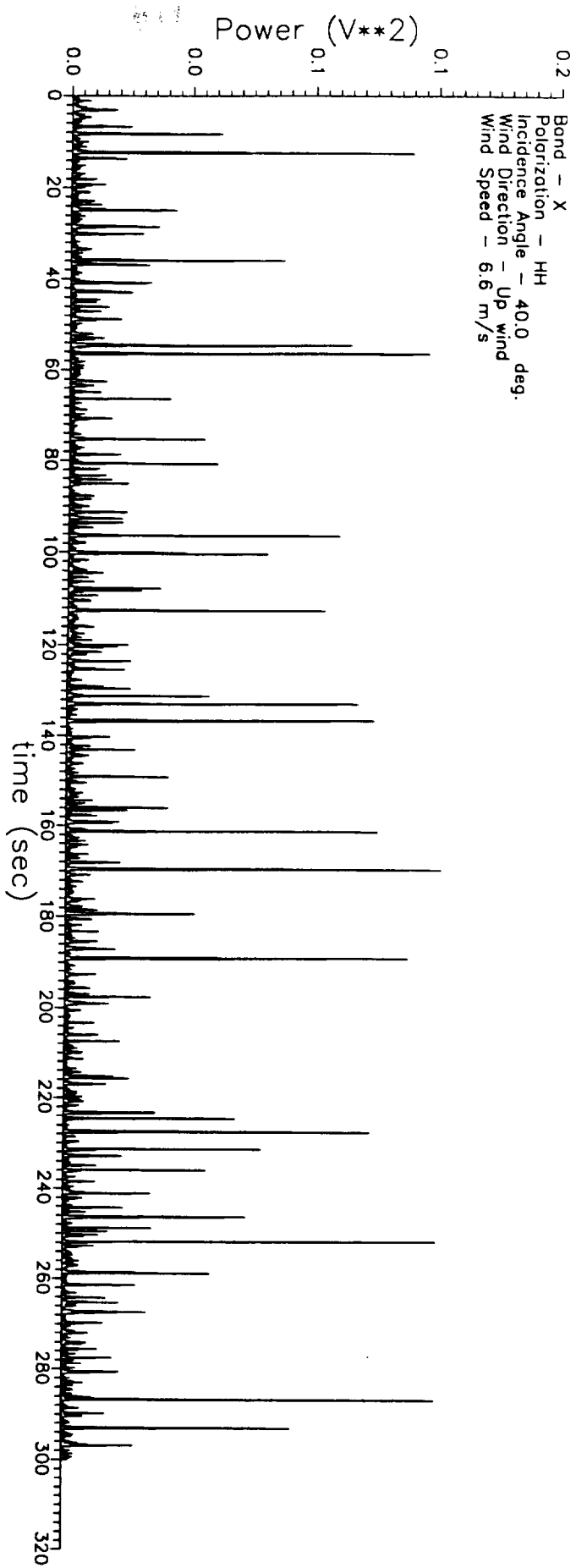


Run 9, 17:25, July 19, 1989

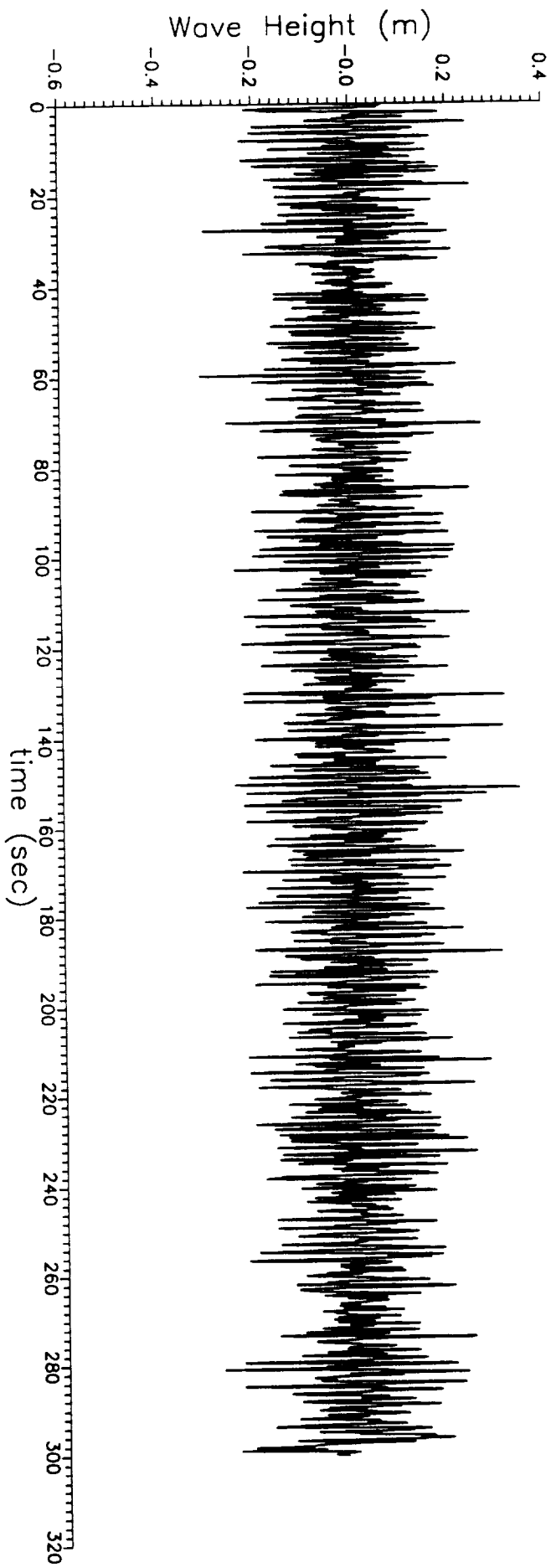
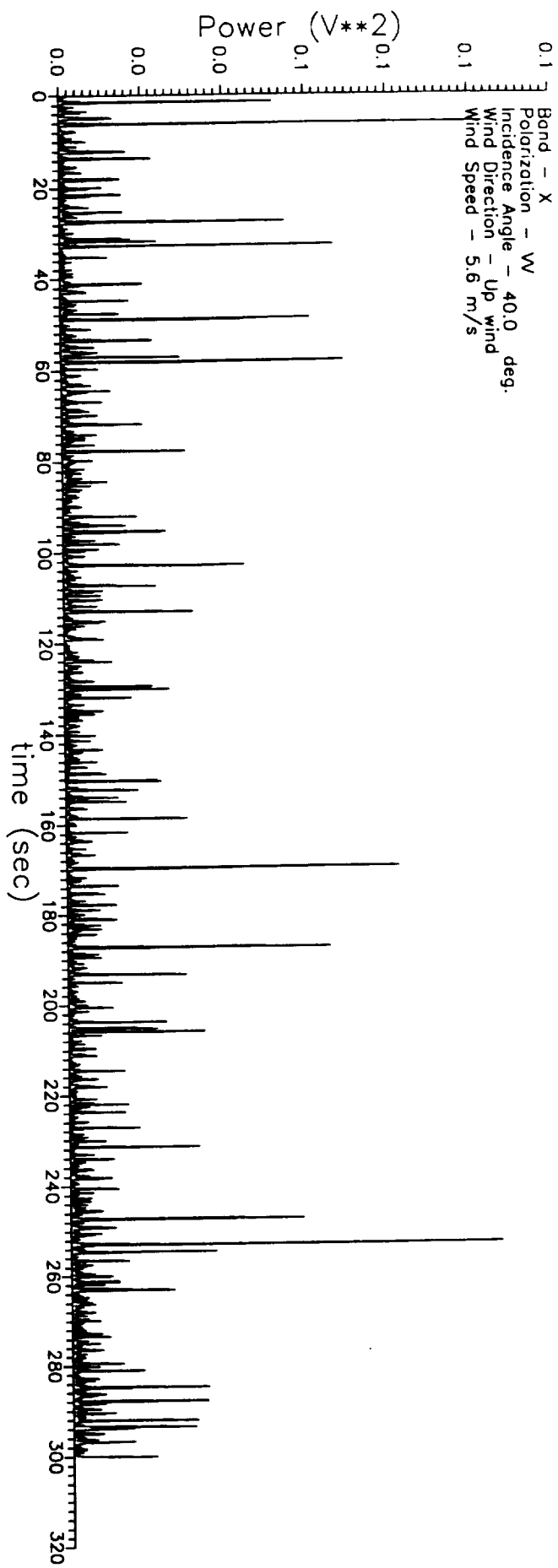


Run 13, 17:55, July 19, 1989

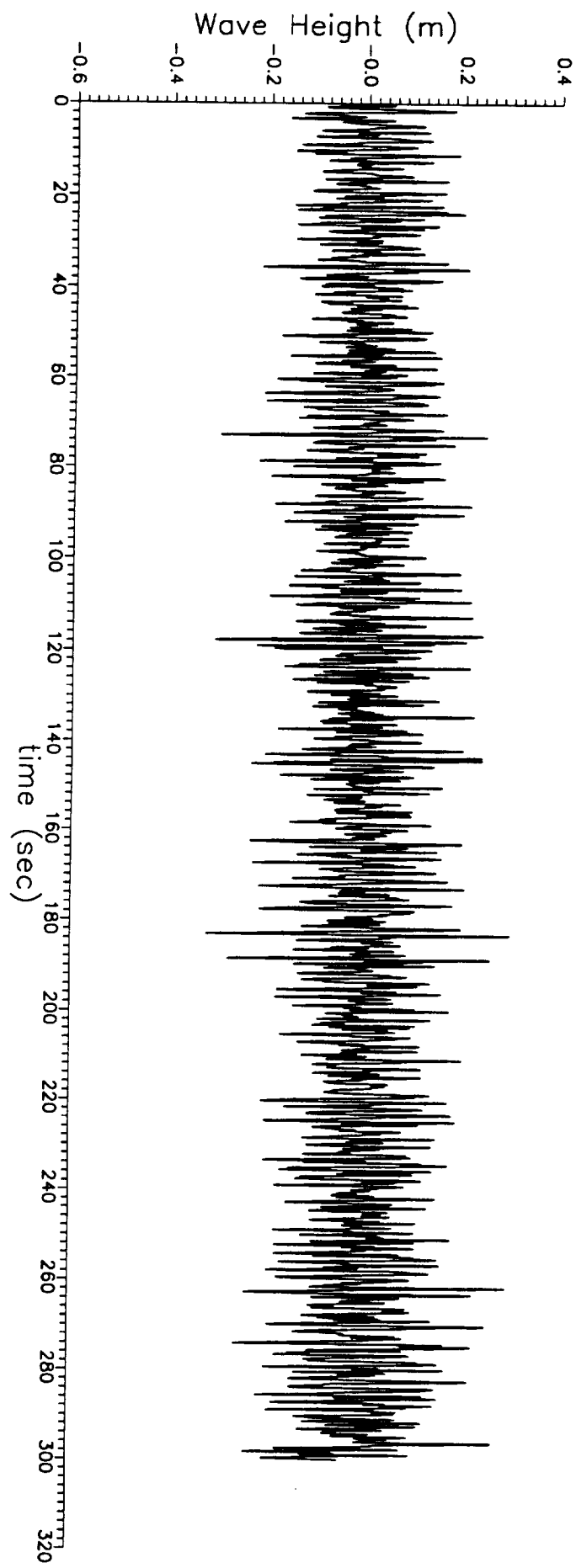
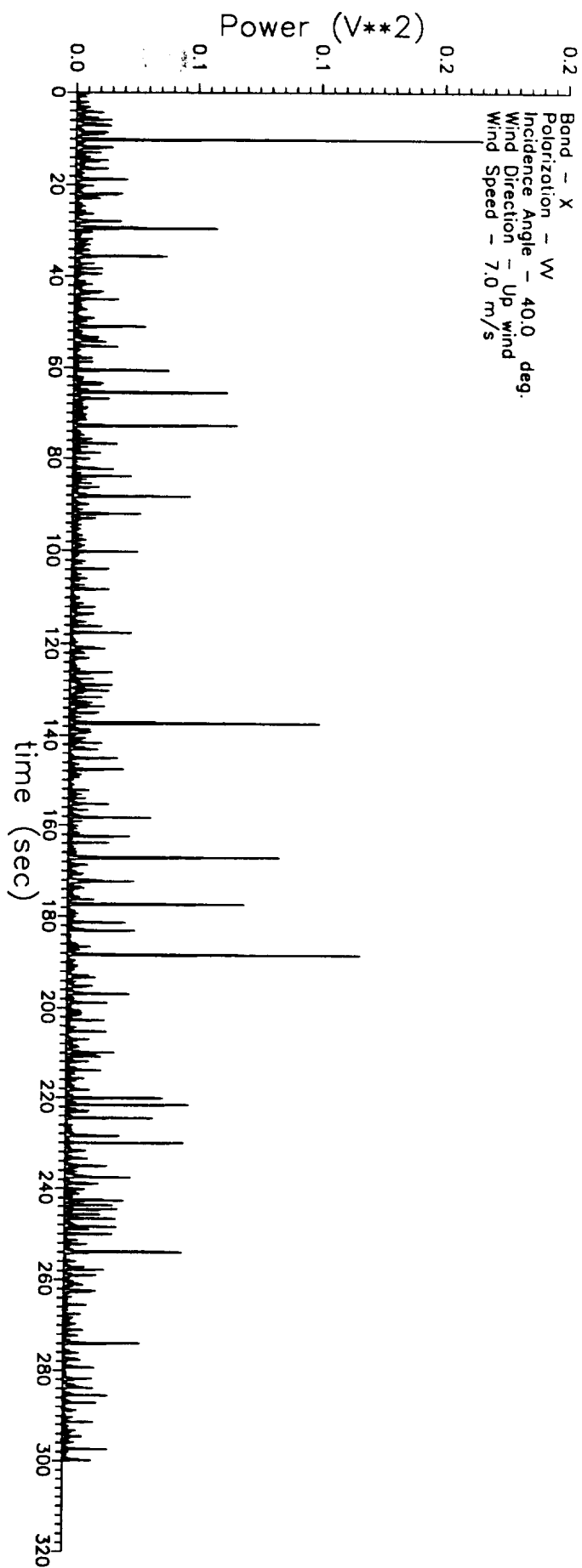
Band - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



Run 15, 18:11, July 19, 1989

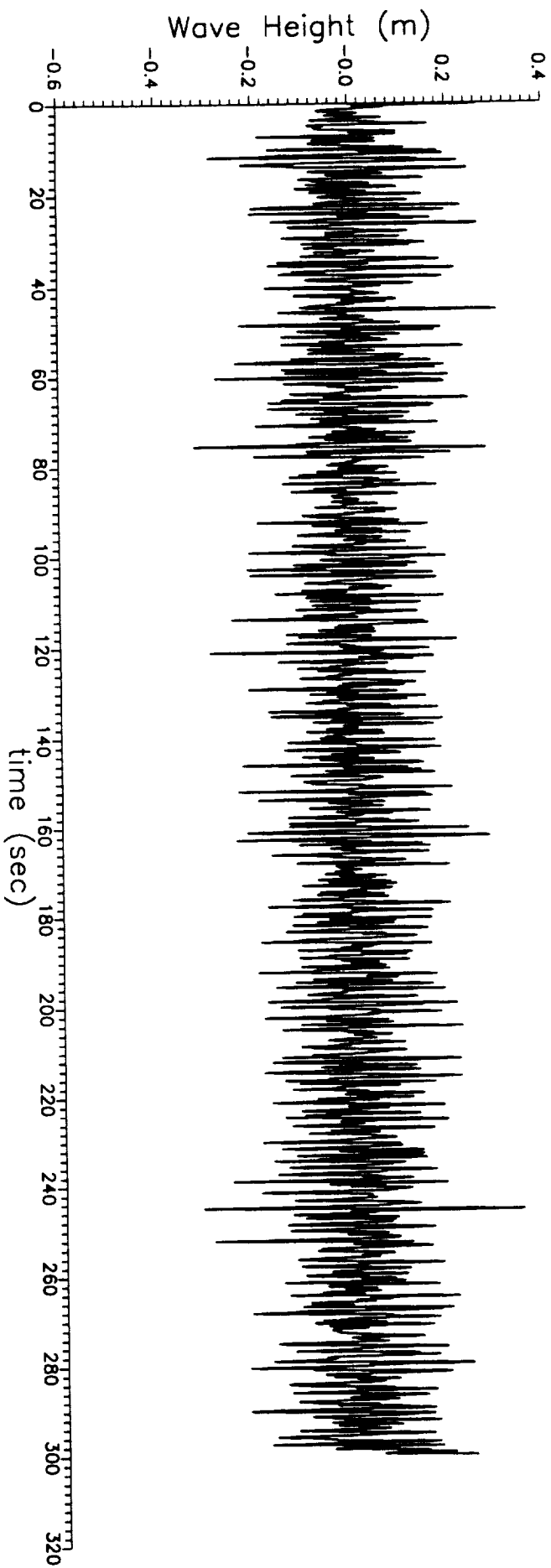
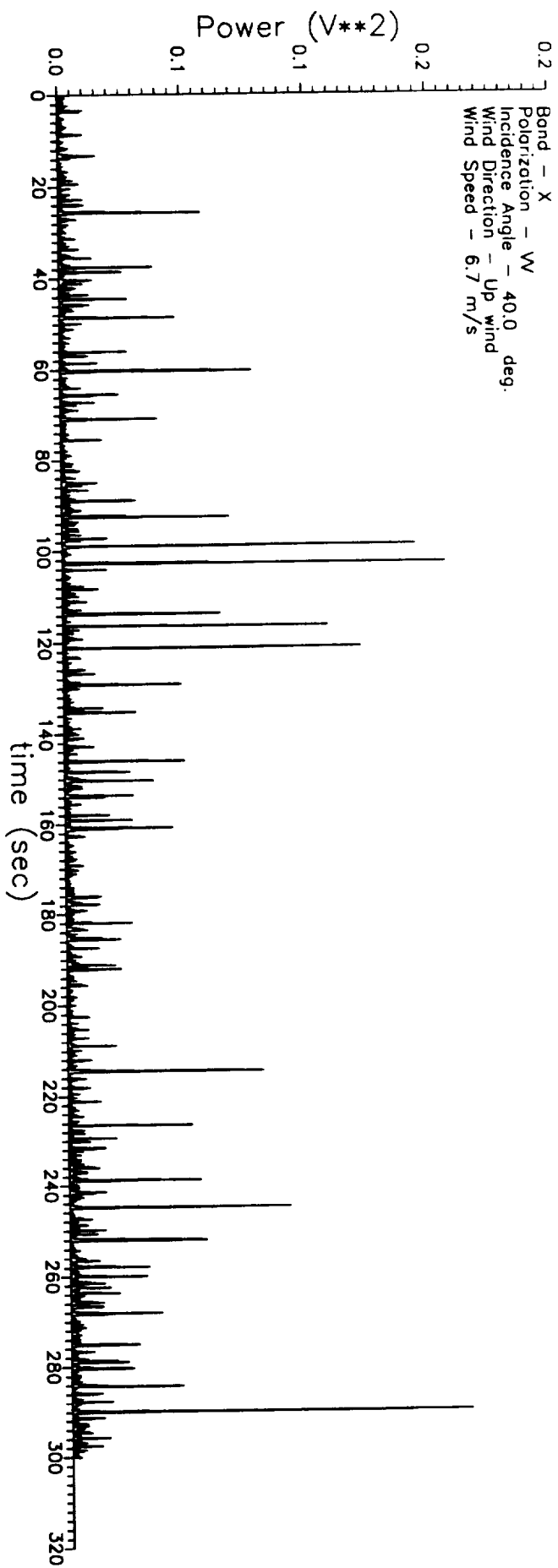


Run 16, 18:17, July 19, 1989



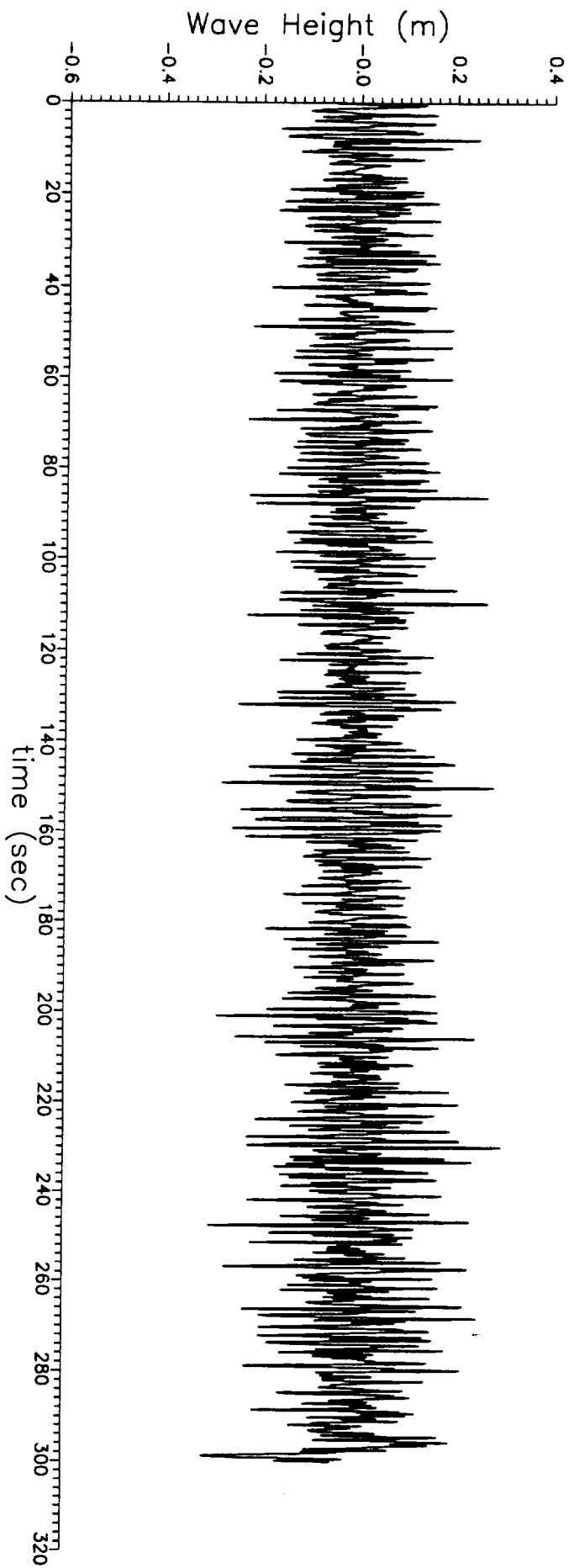
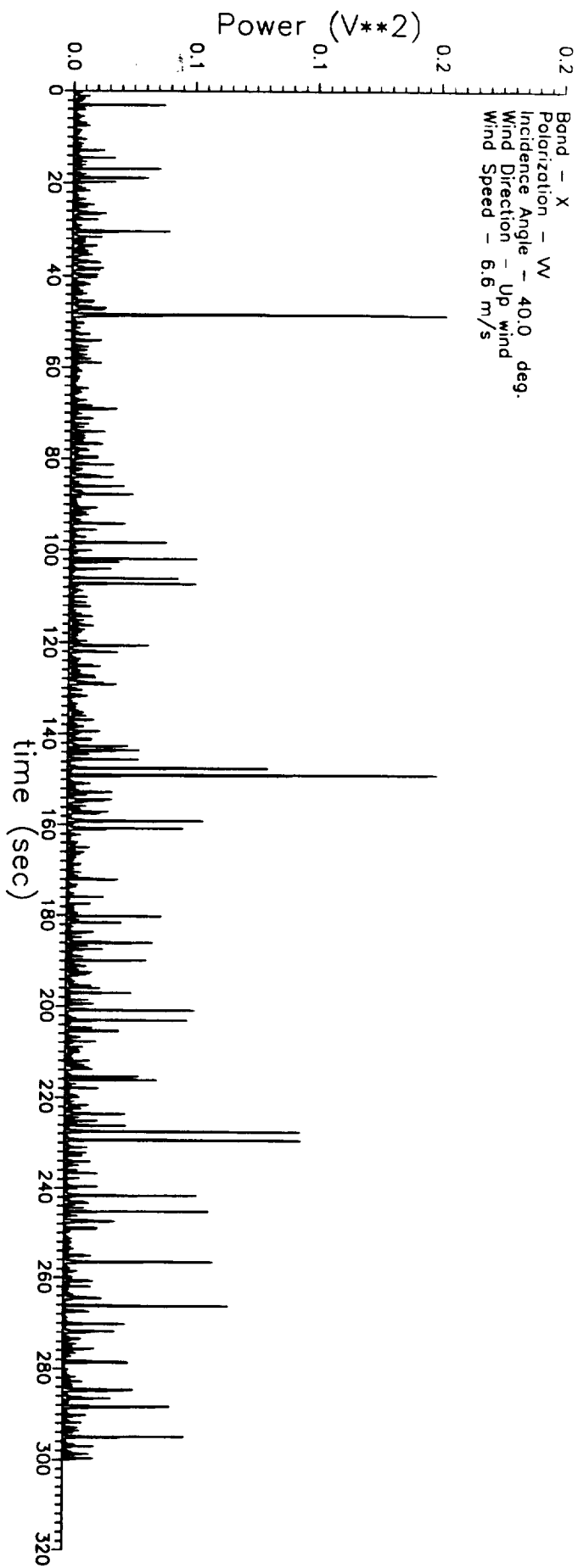
Run 17, 18:22, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.7 m/s

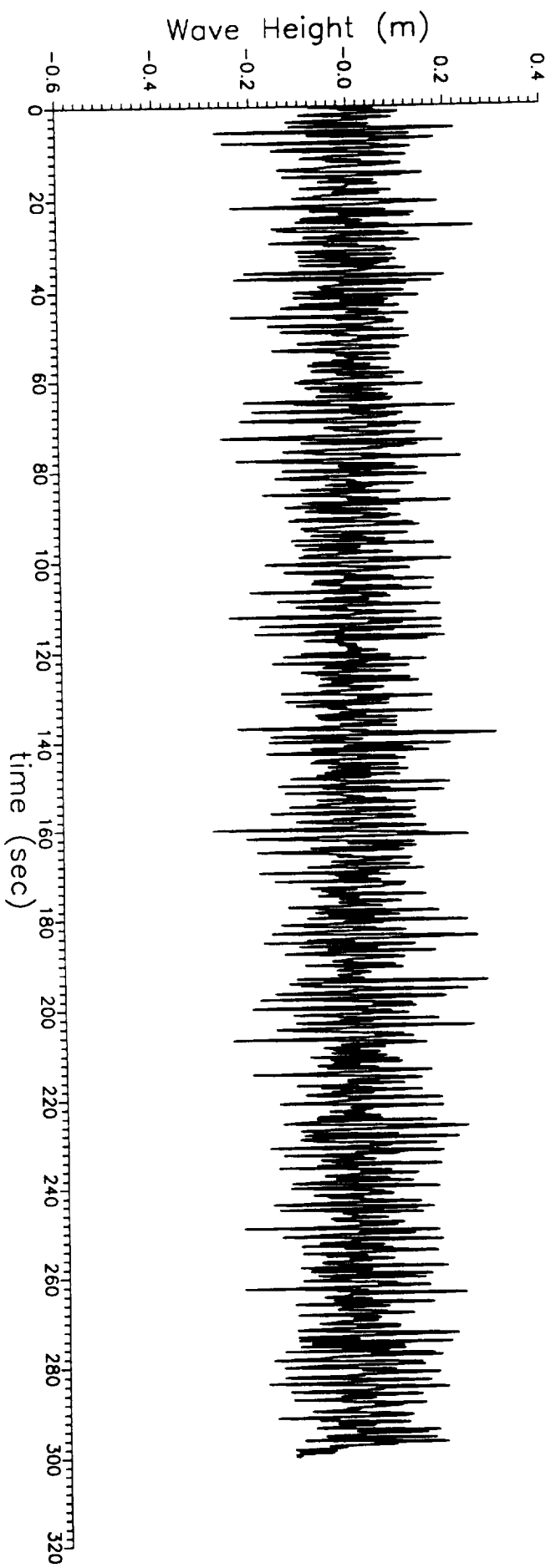
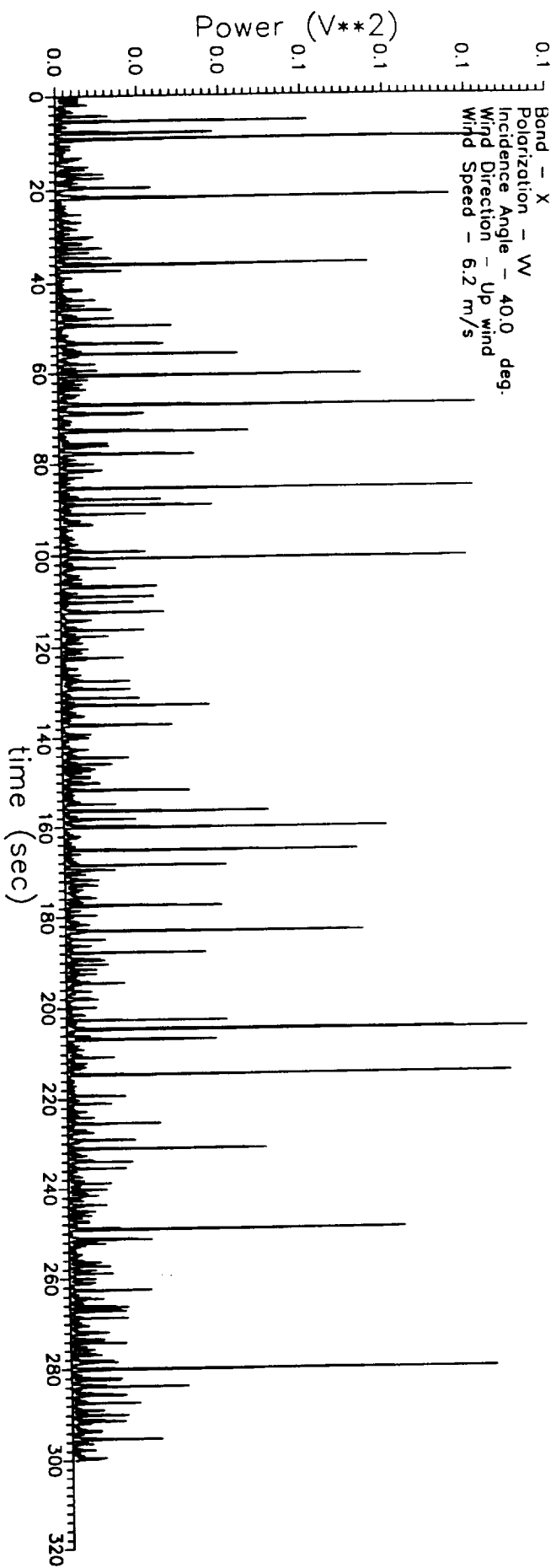


Run 18, 18:28, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s

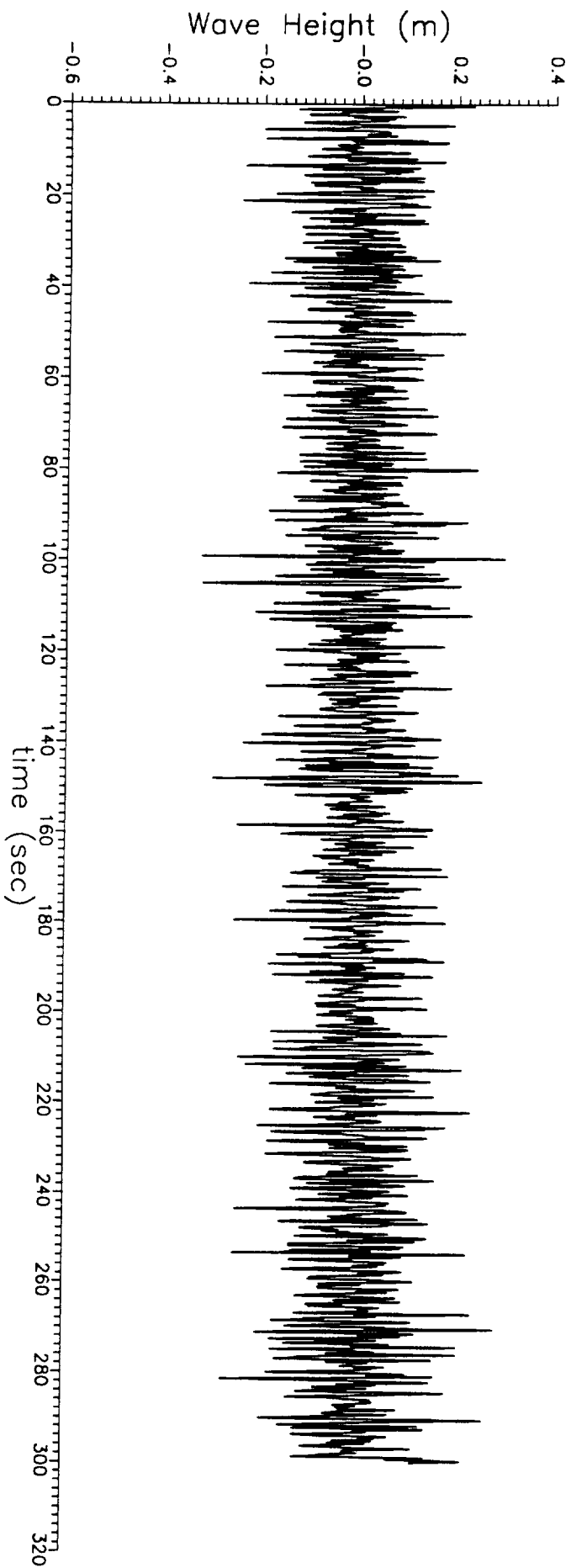
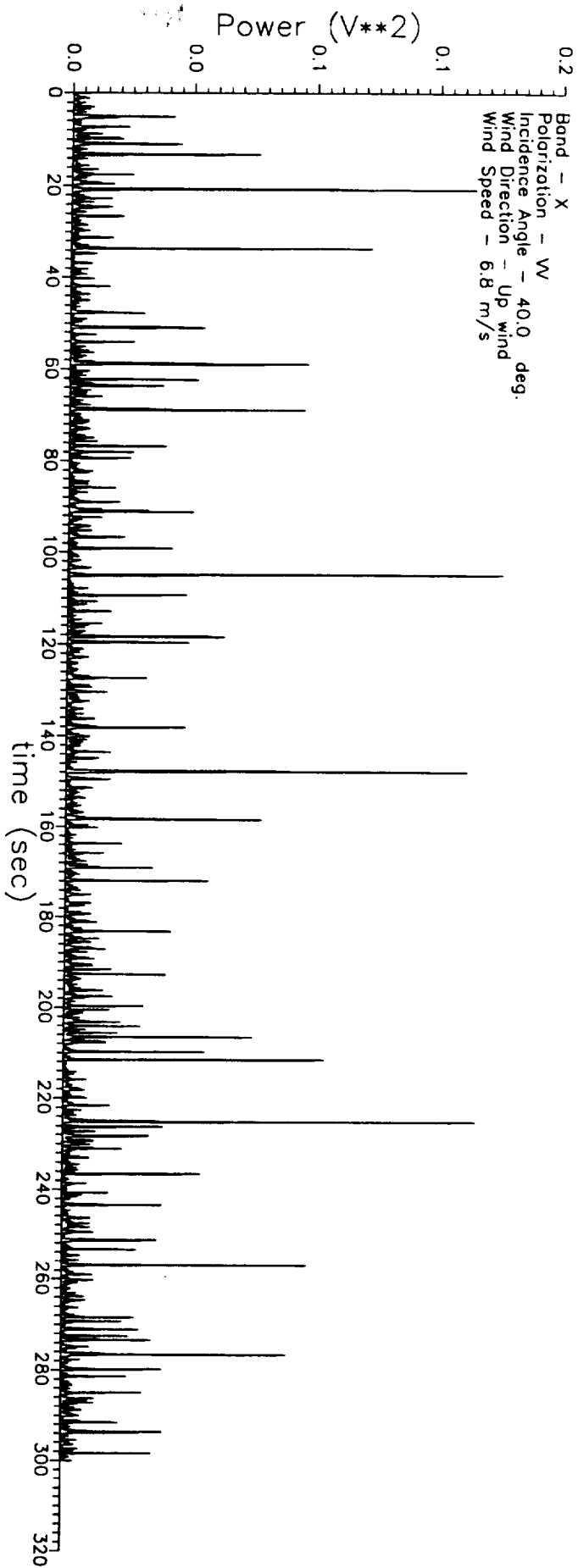


Run 19, 18:33, July 19, 1989

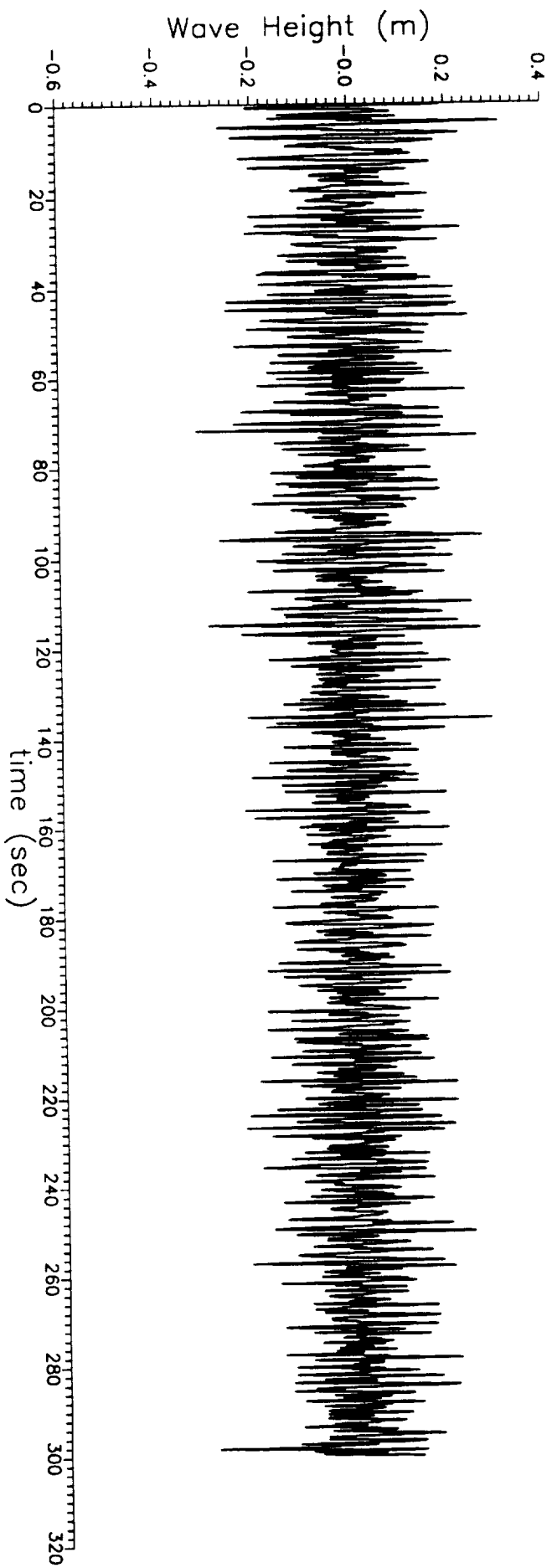
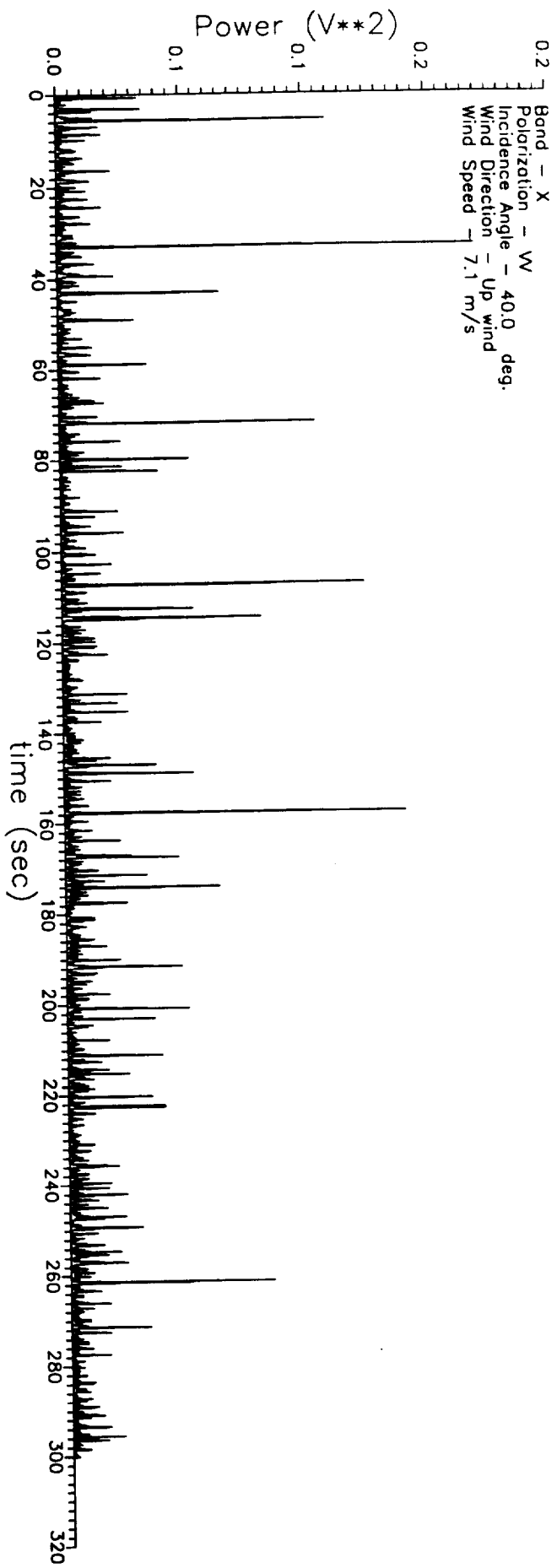


Run 20, 18:38, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.8 m/s

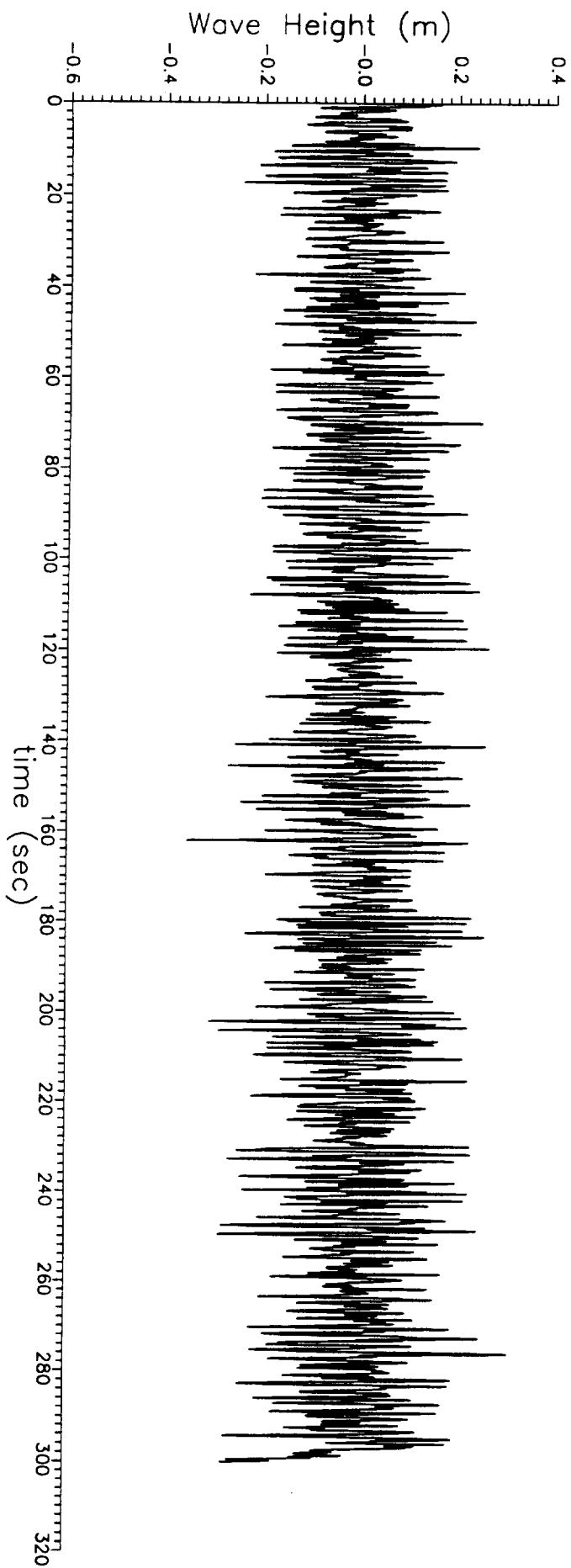
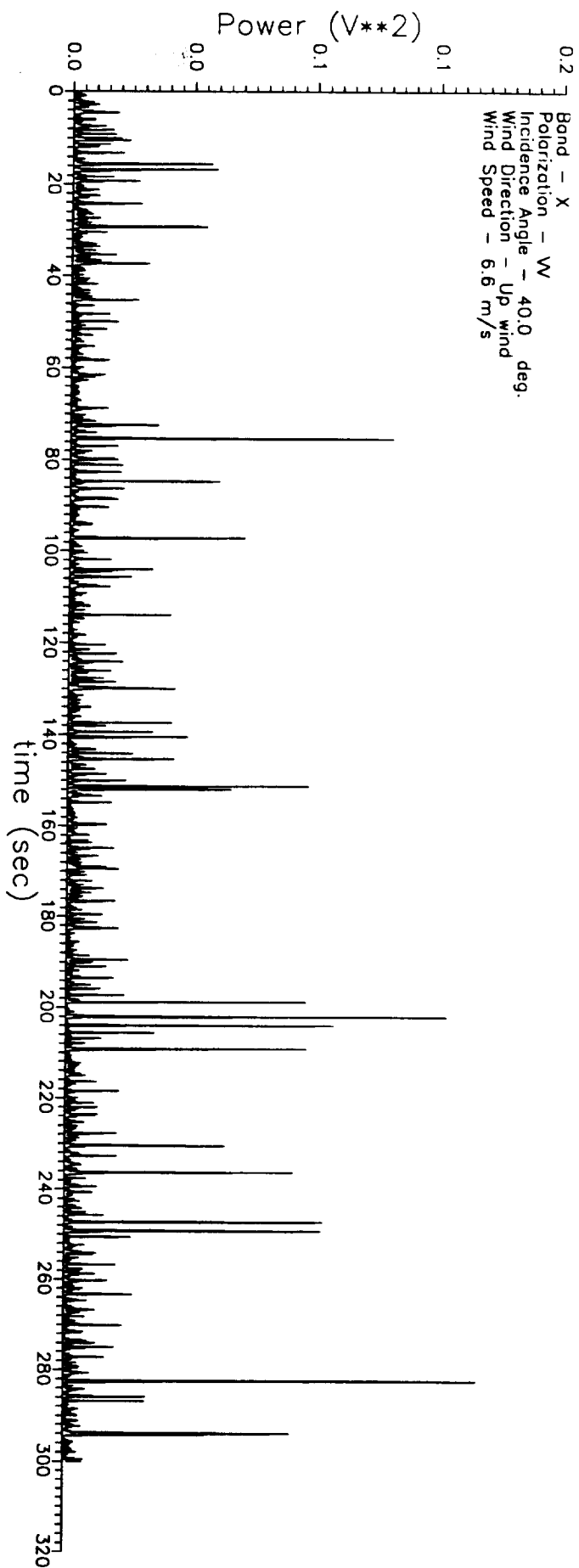


Run 21, 18:44, July 19, 1989



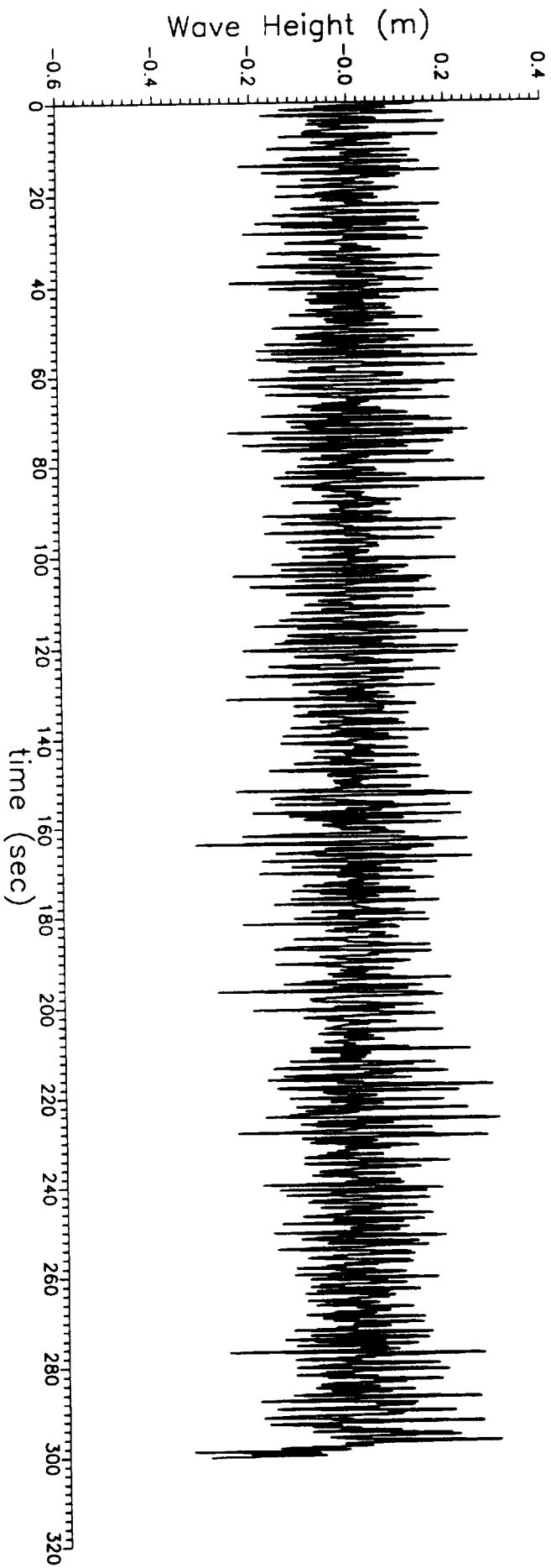
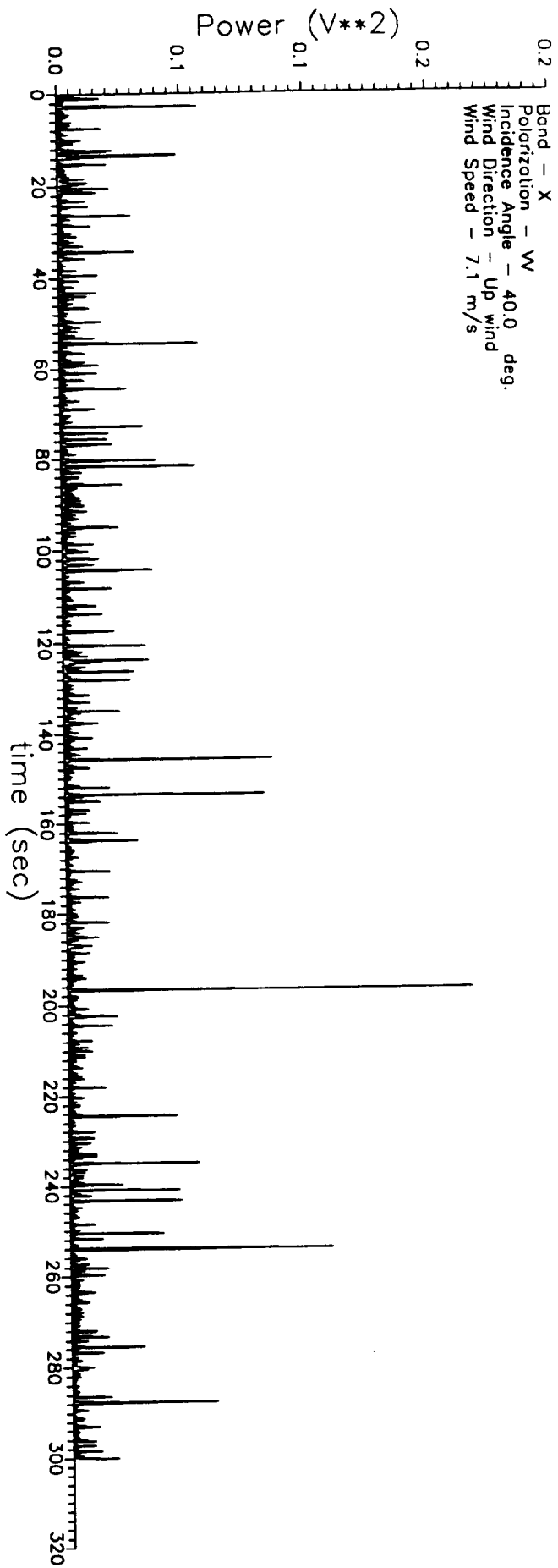
Run 22, 18:49, July 19, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



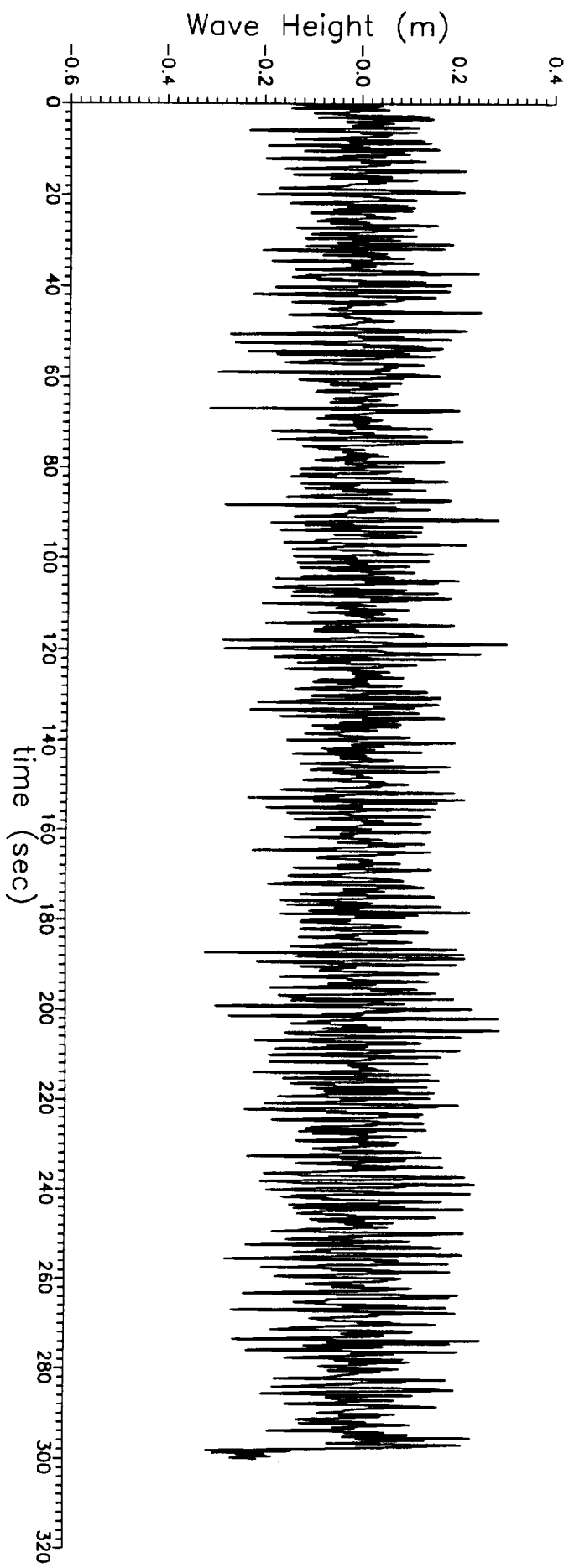
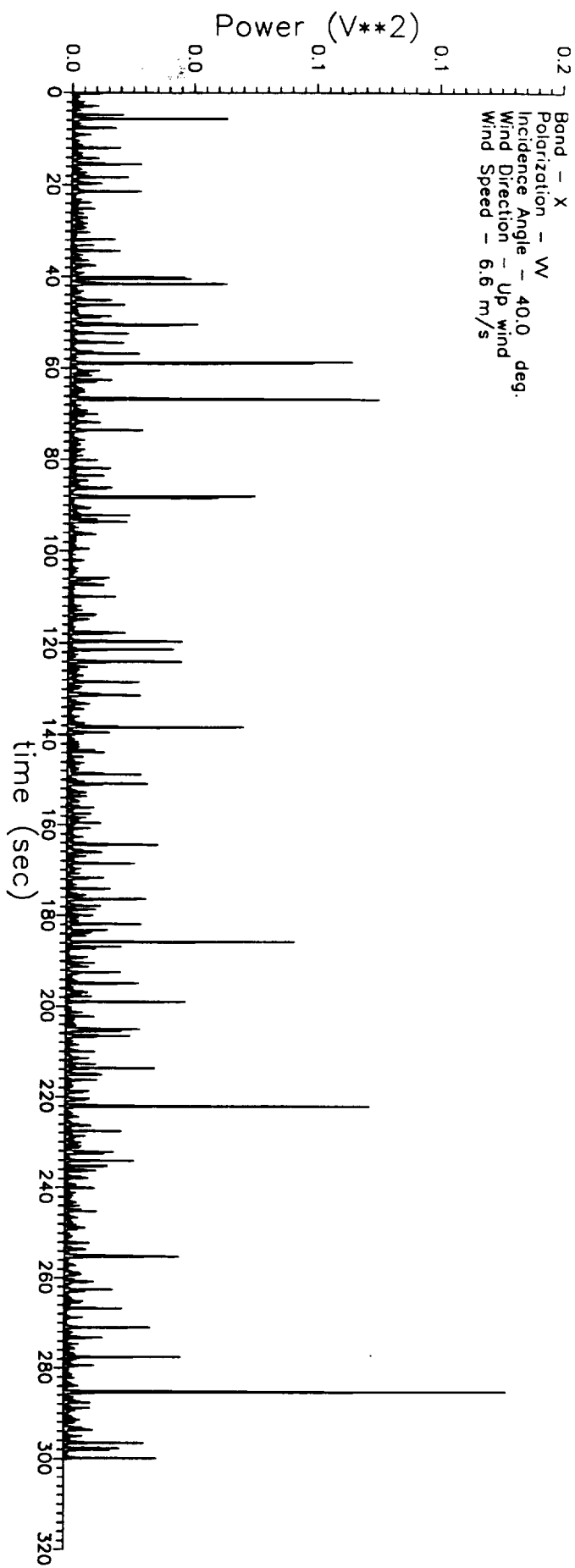
Run 23, 18:55, July 19, 1989

Bond - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.1 m/s

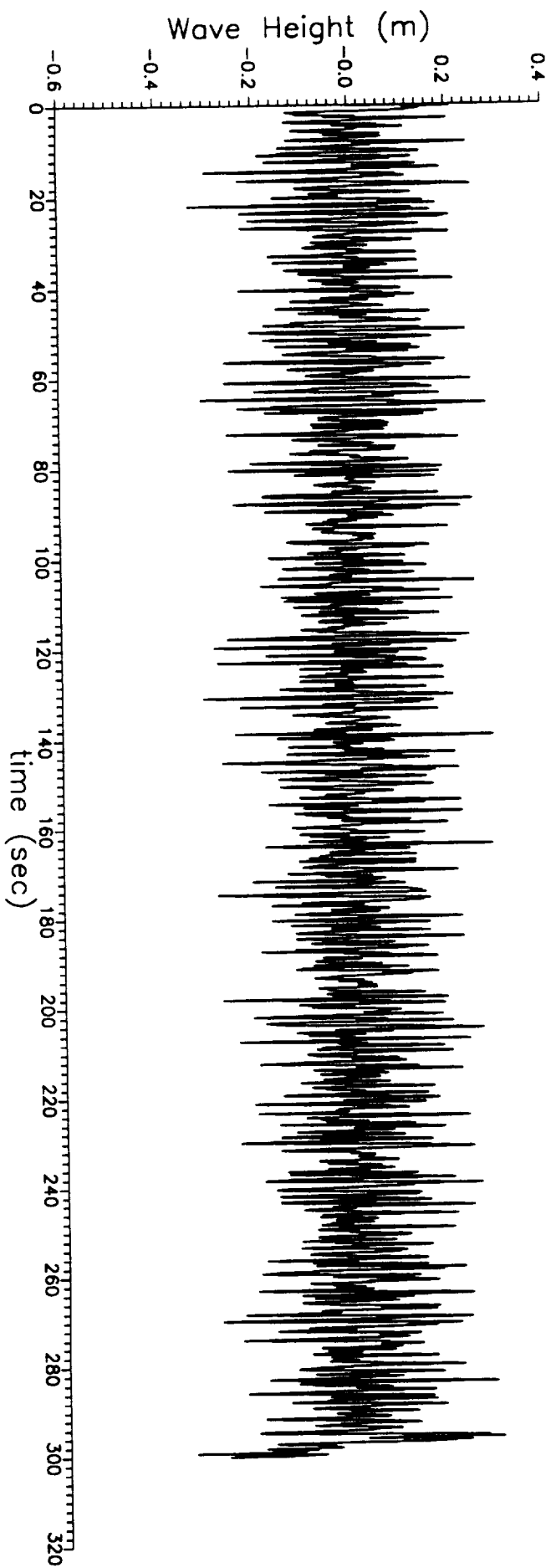
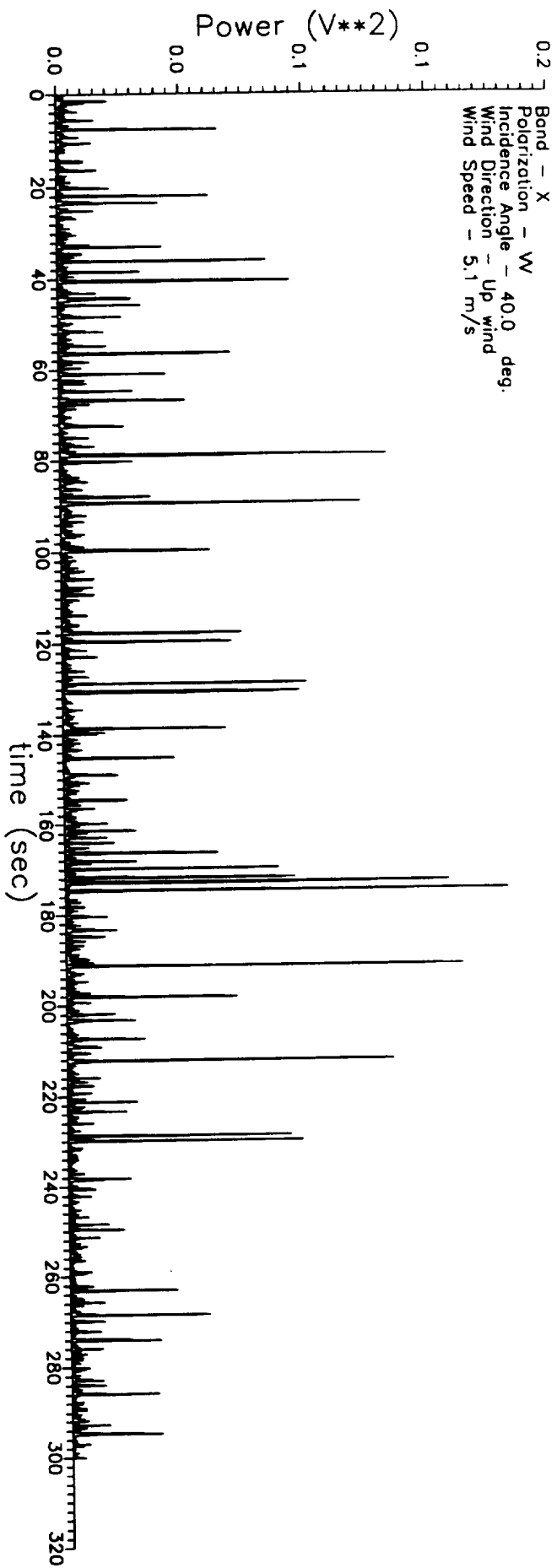


Run 24, 19:00, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s

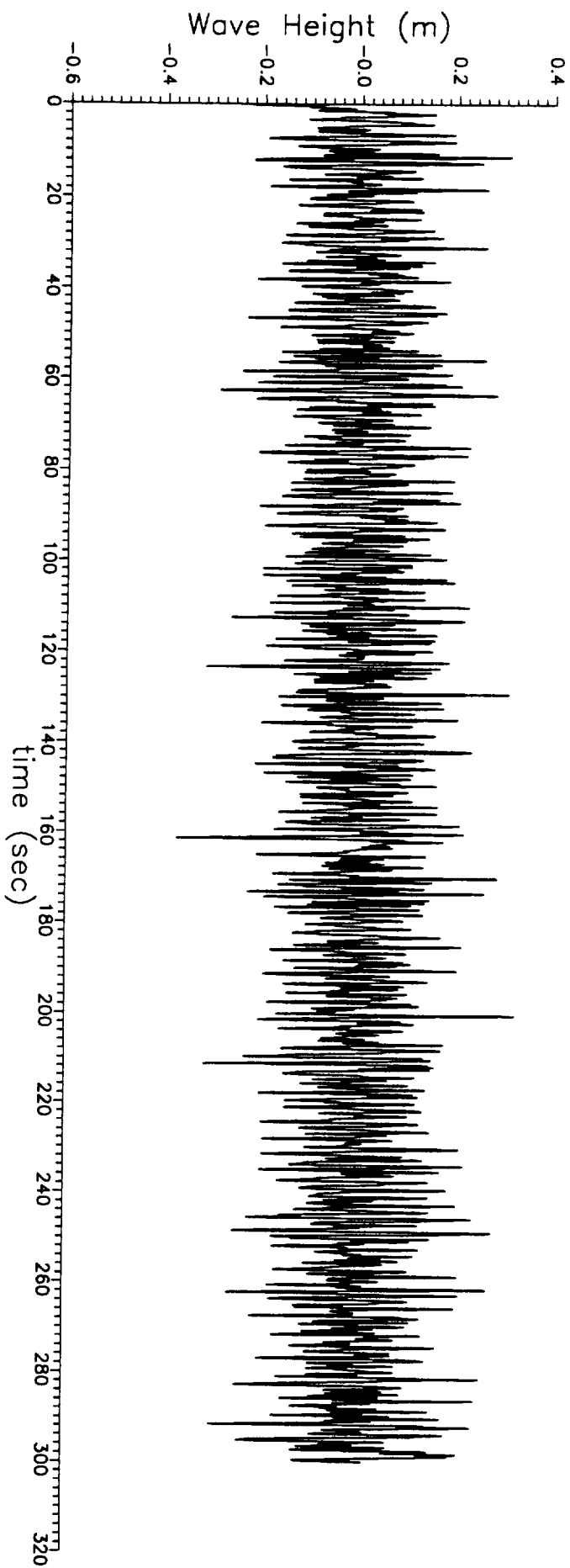
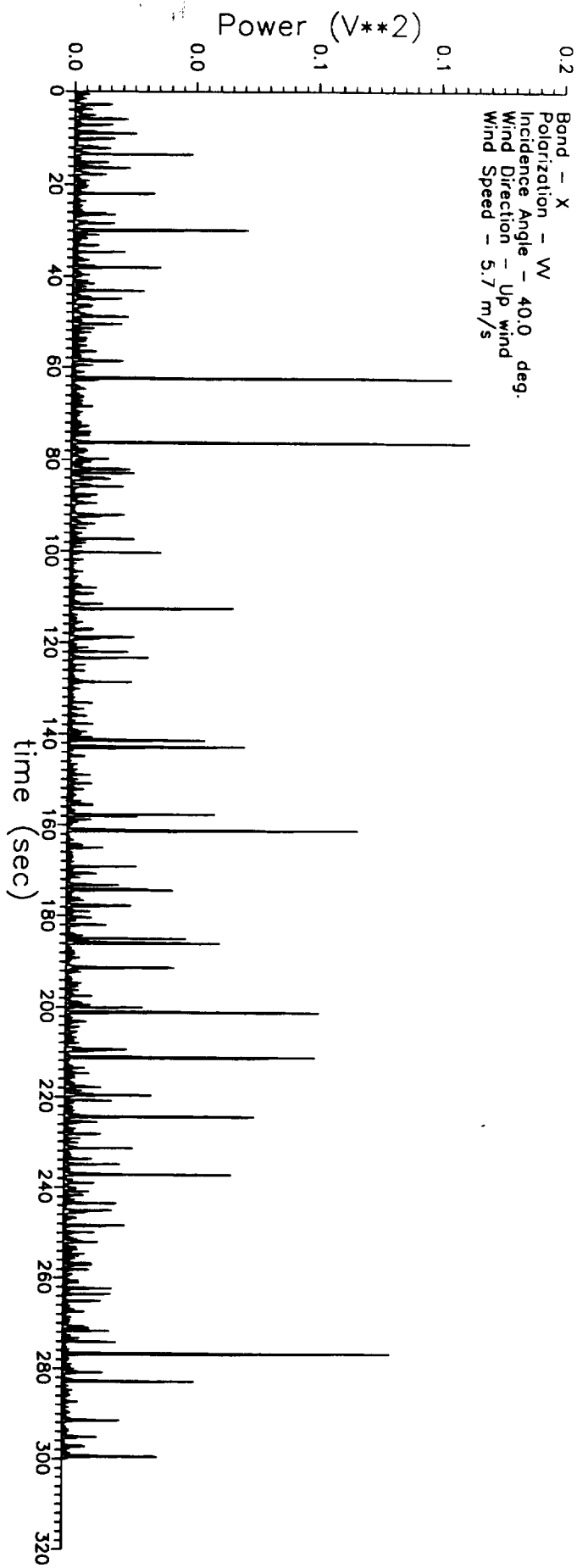


Run 25, 19:15, July 19, 1989



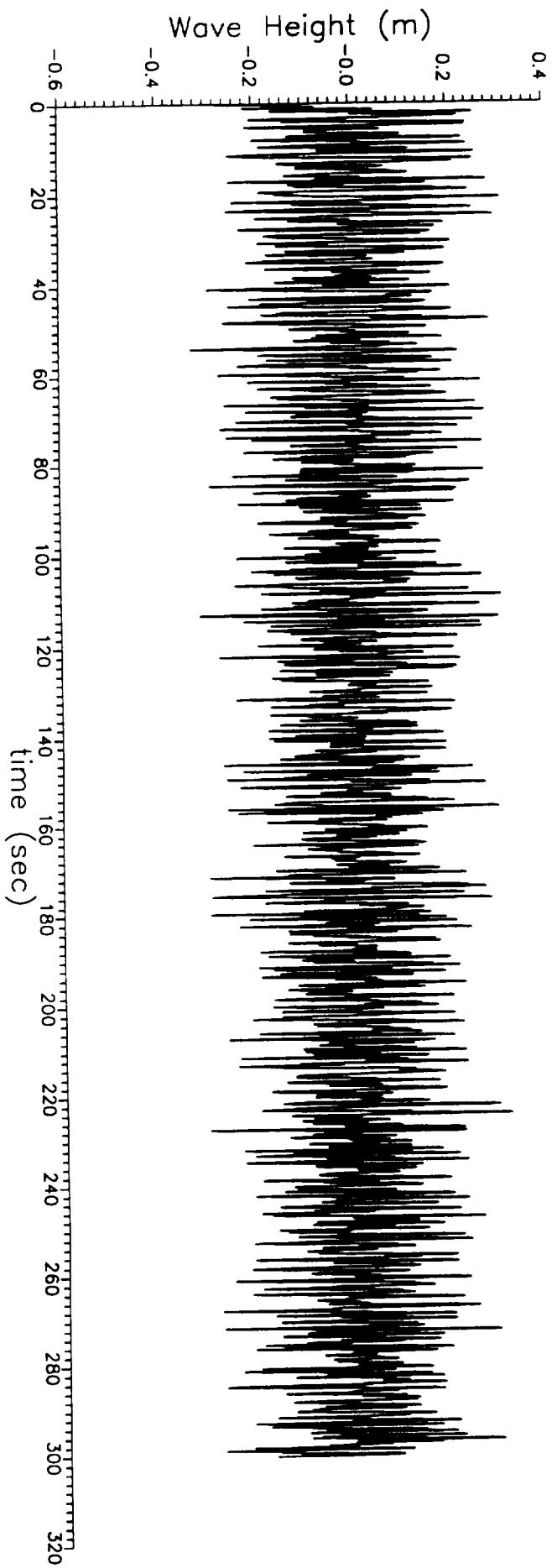
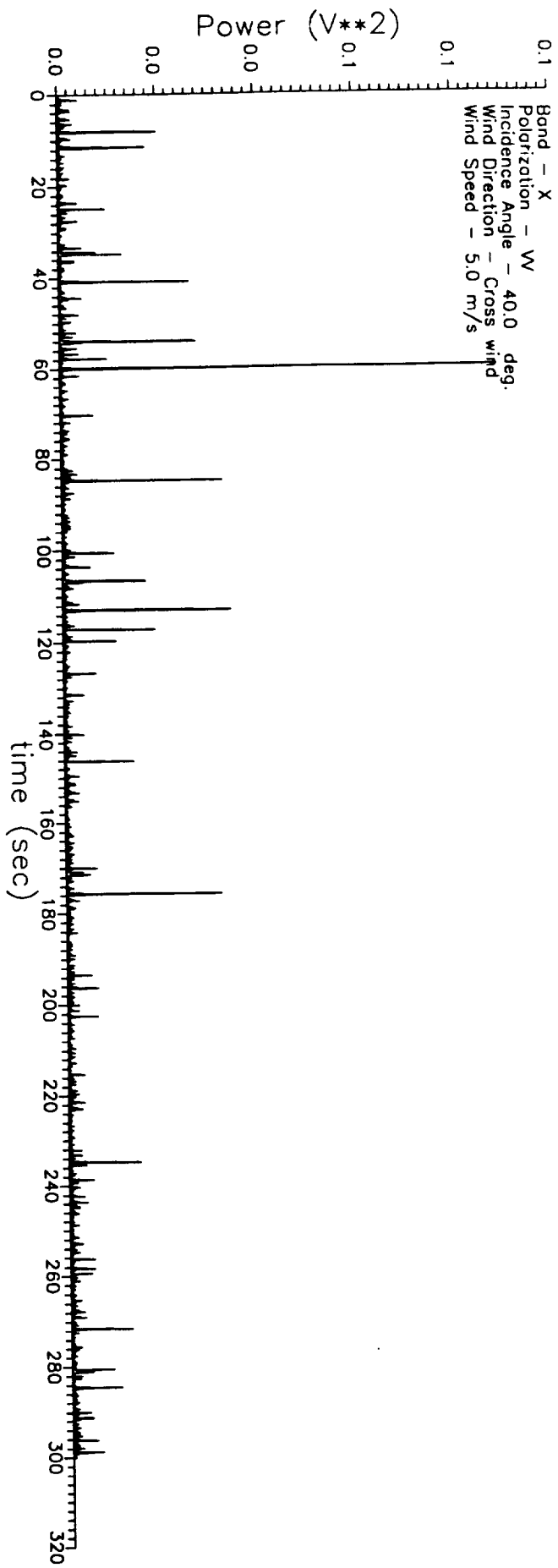
Run 26, 19:11, July 19, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.7 m/s



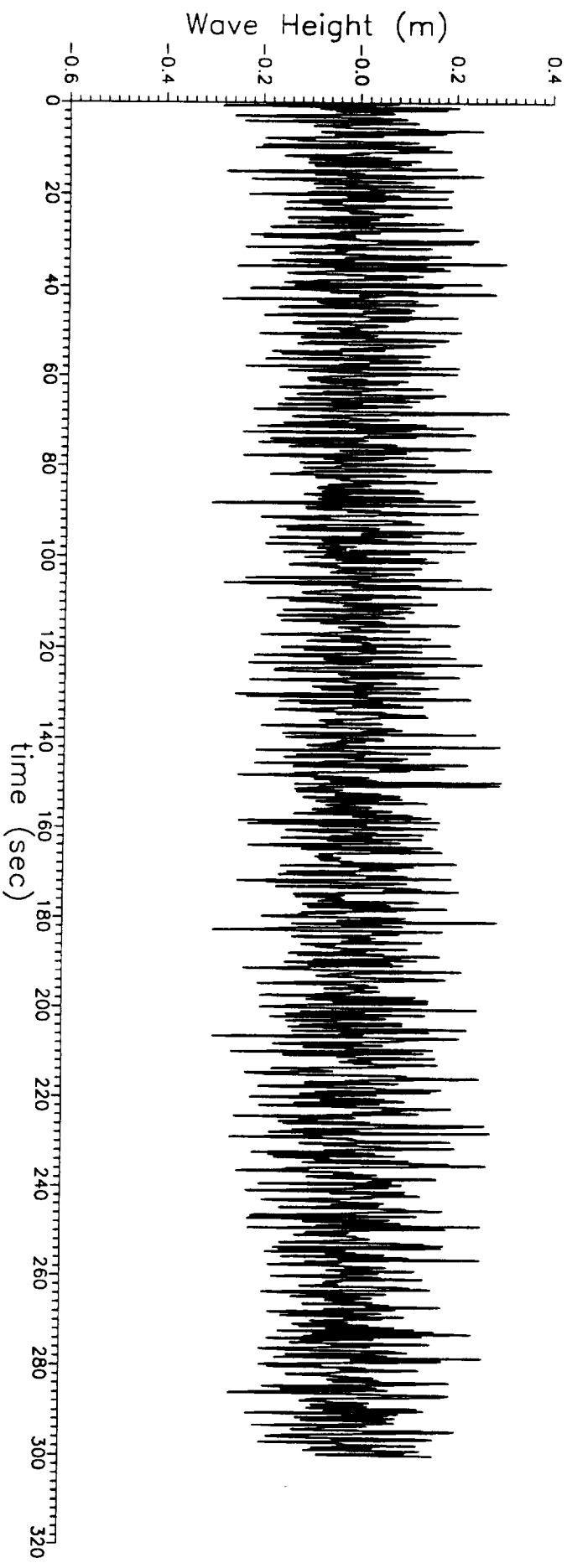
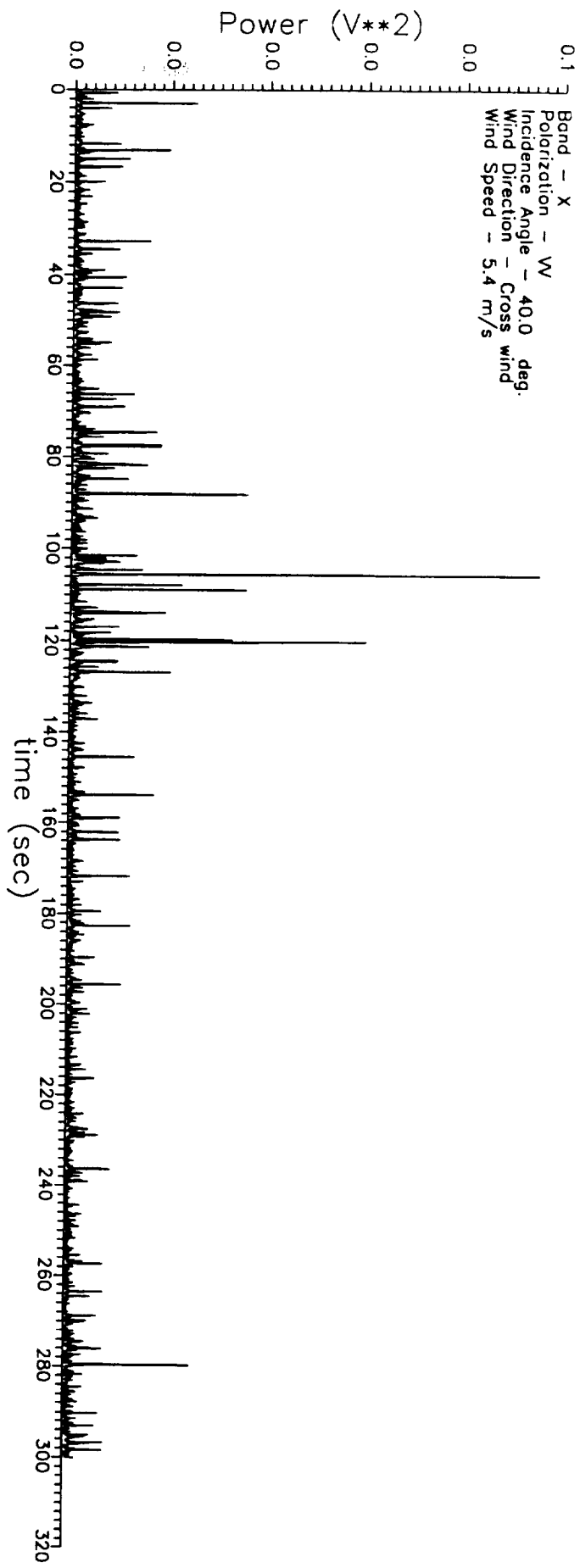
Run 30, 19:51, July 19, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.0 m/s



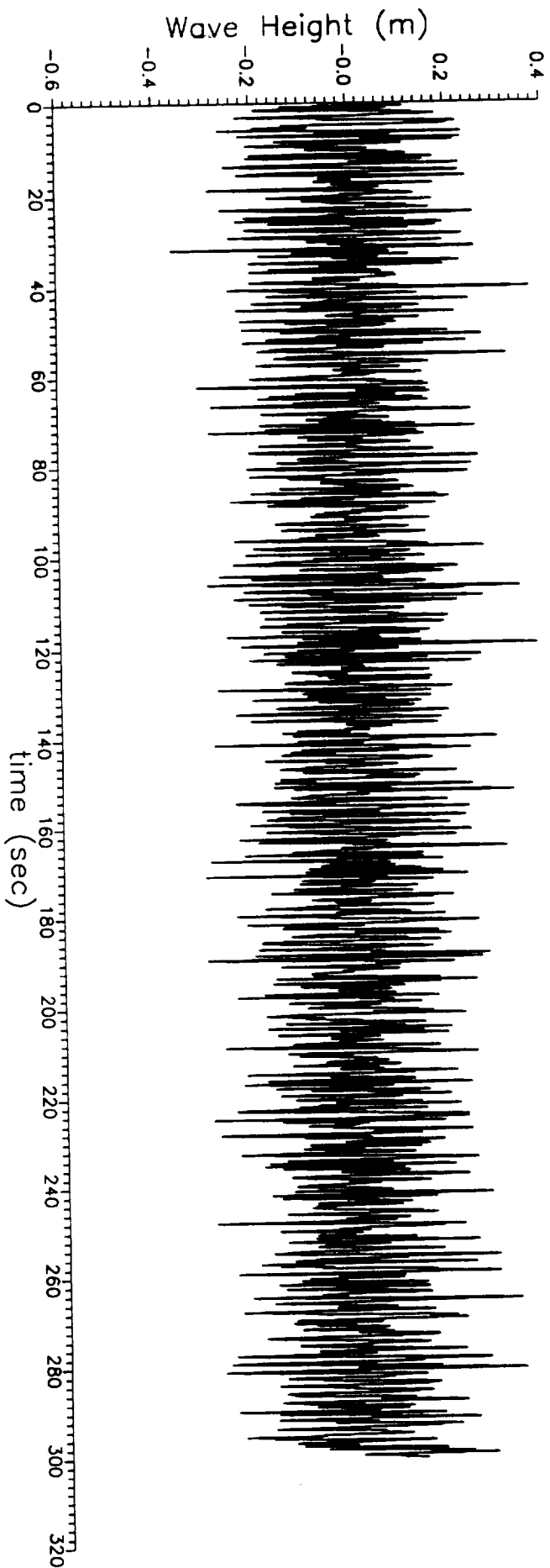
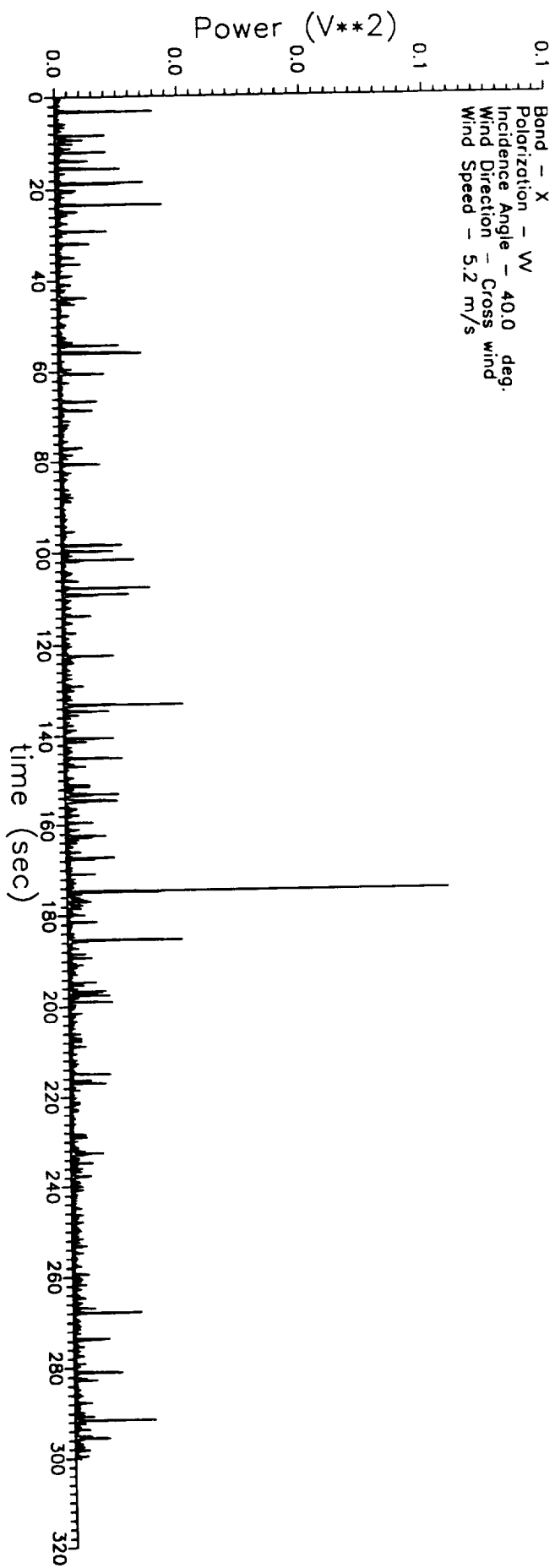
Run 31, 19:56, July 19, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.4 m/s



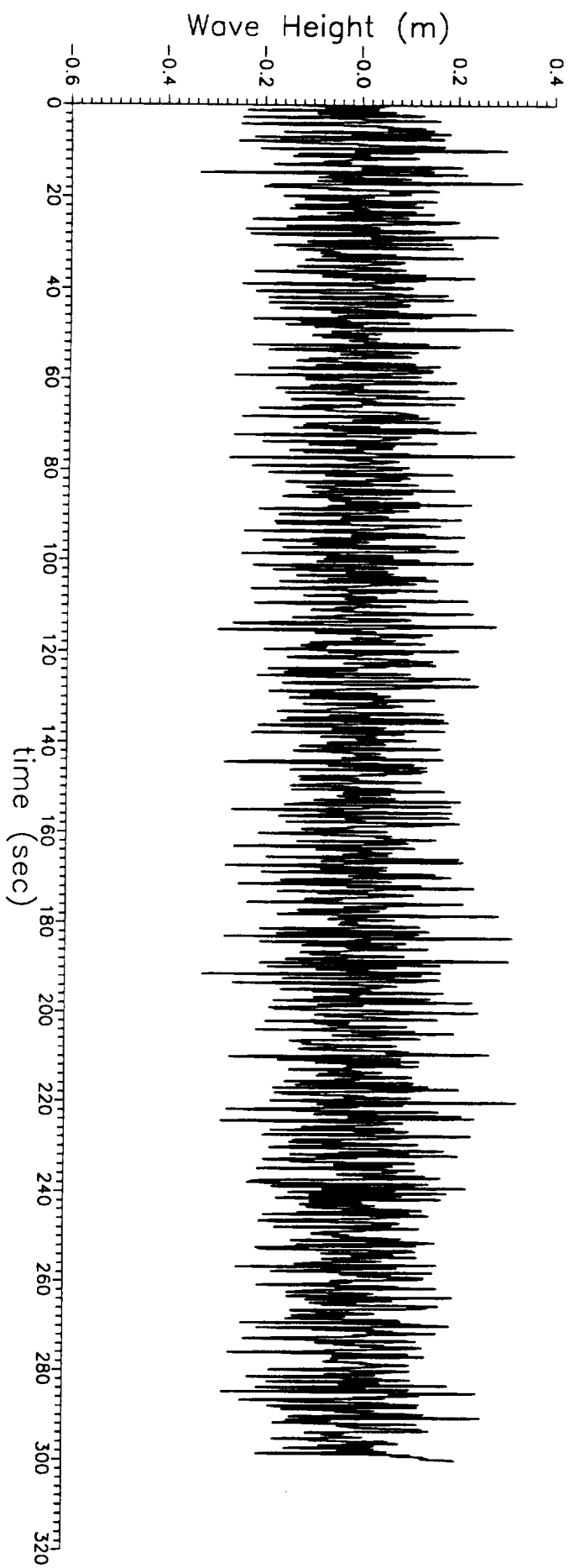
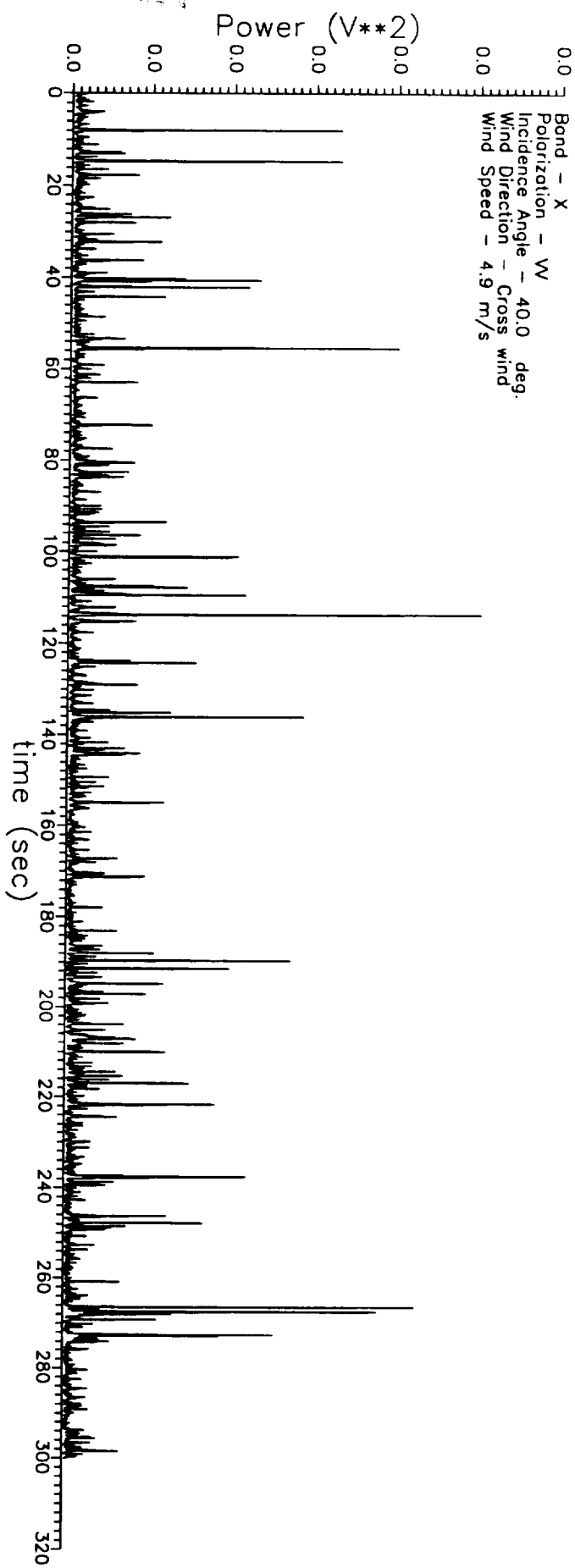
Run 32, 20:01, July 19, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.2 m/s



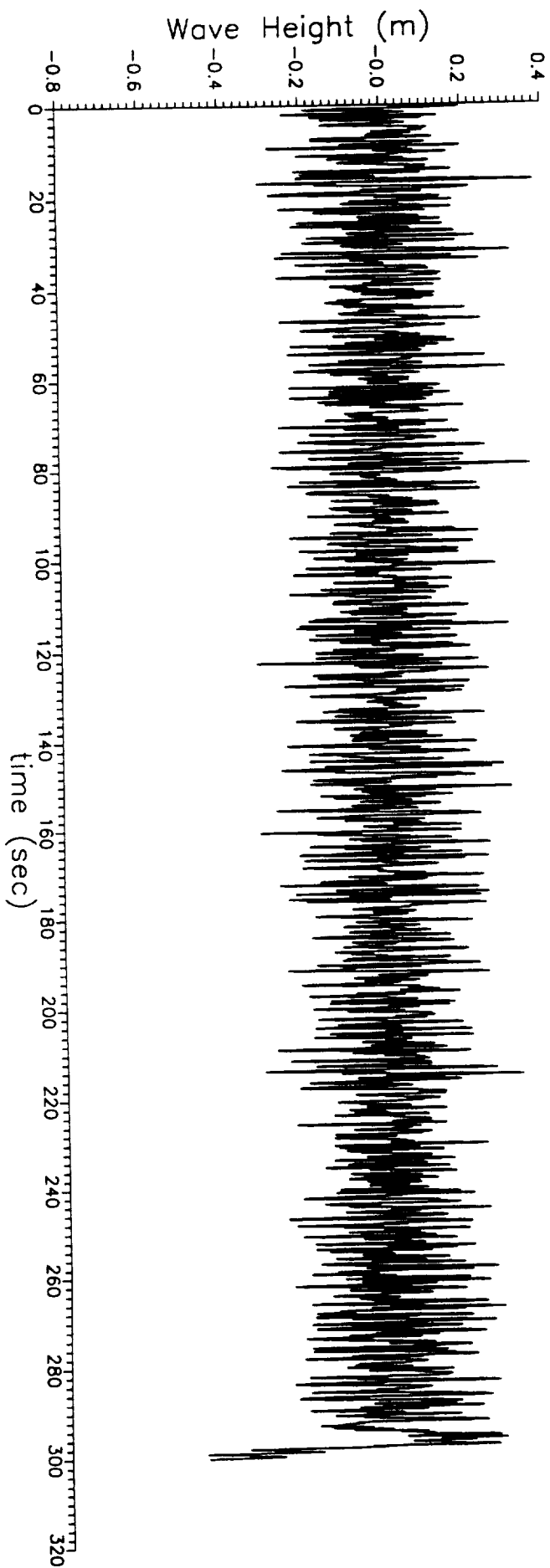
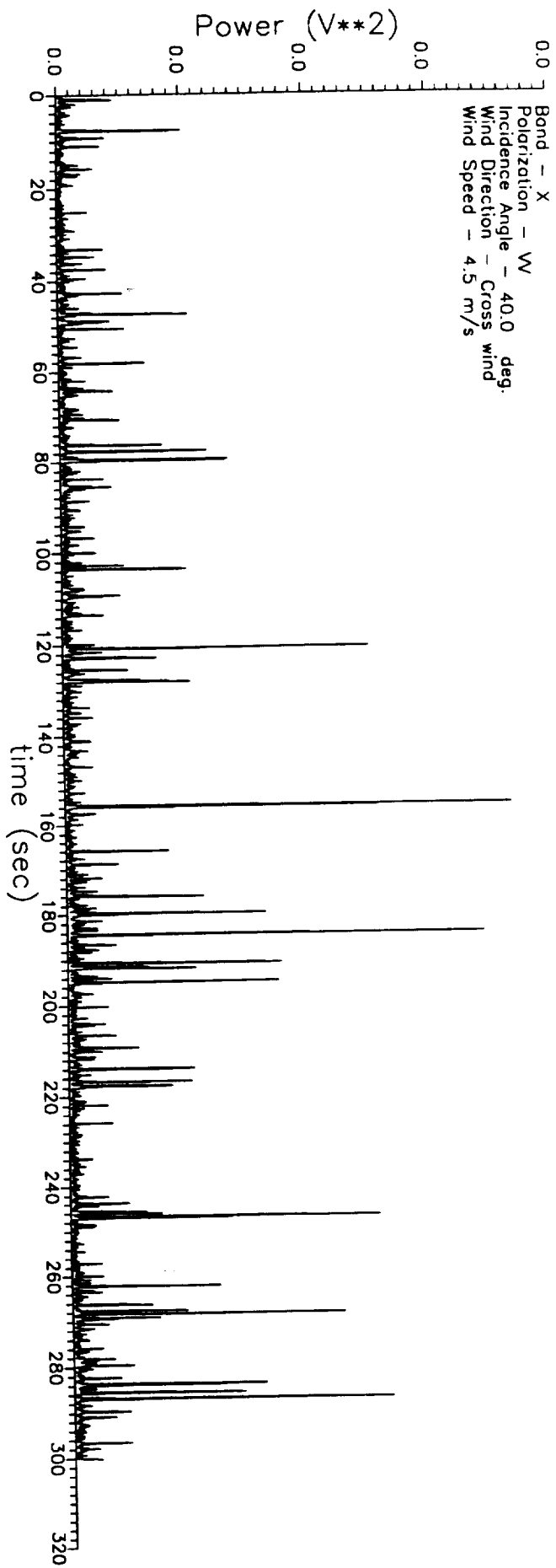
Run 33, 20:07, July 19, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.9 m/s



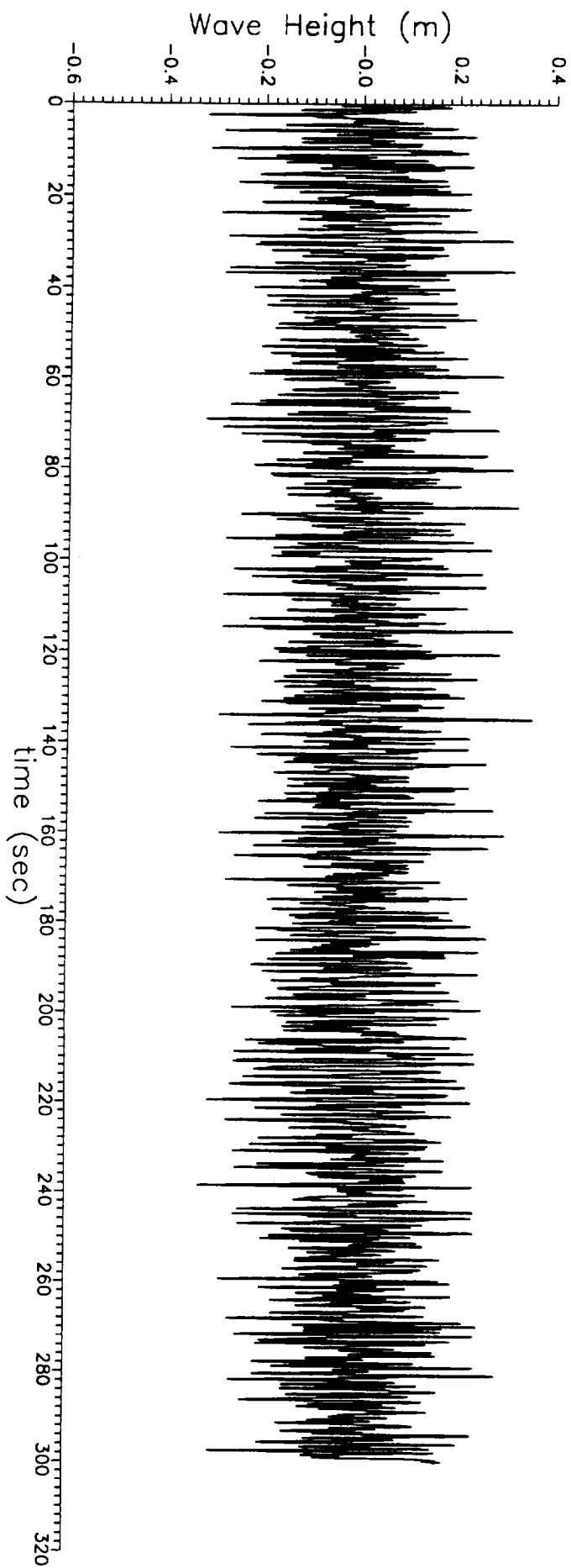
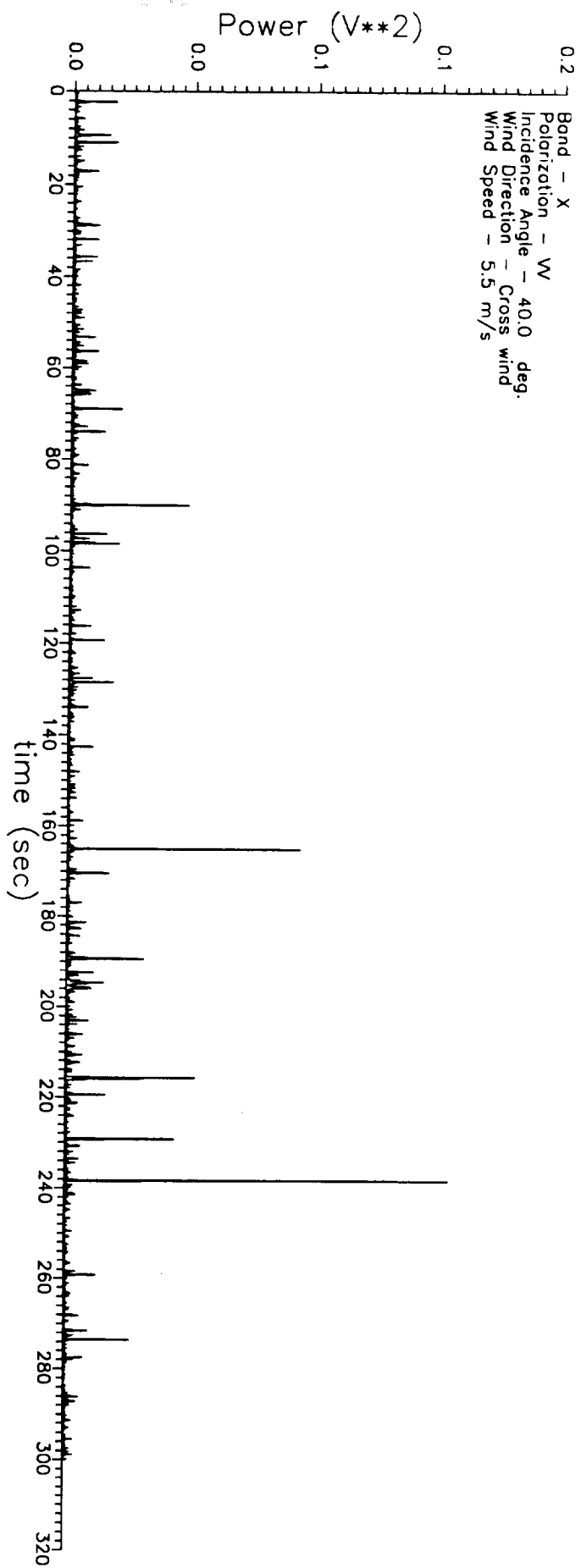
Run 34, 20:12, July 19, 1989

Bond - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.5 m/s



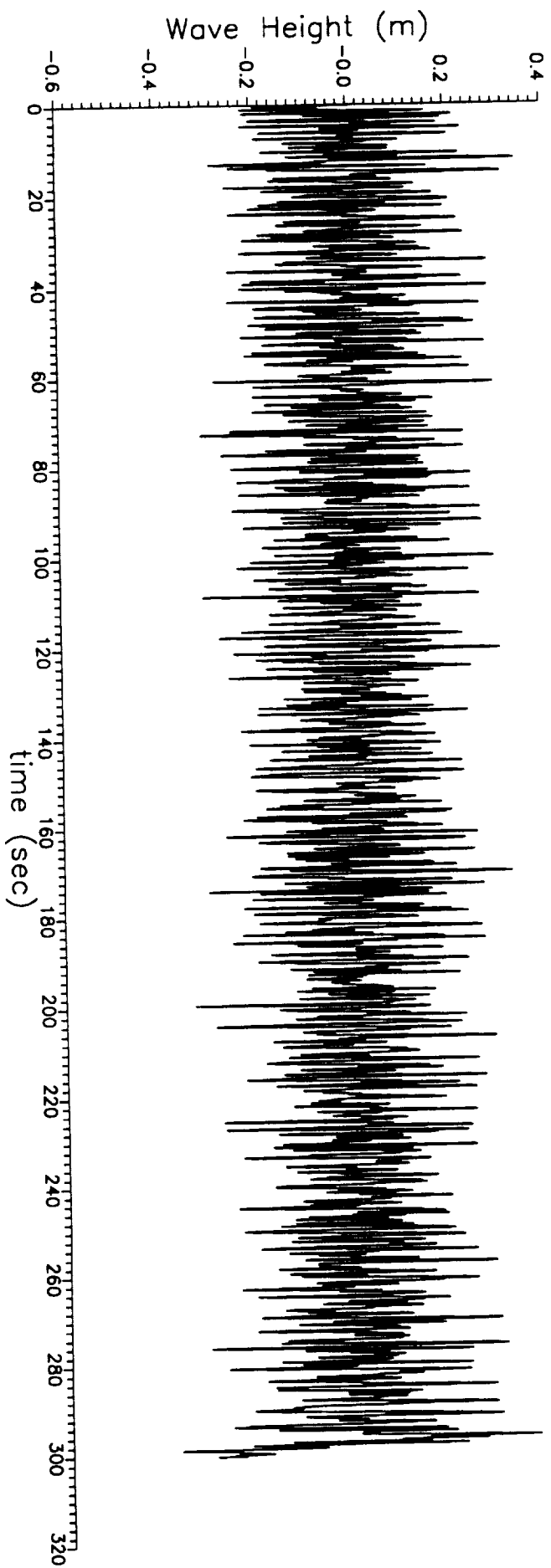
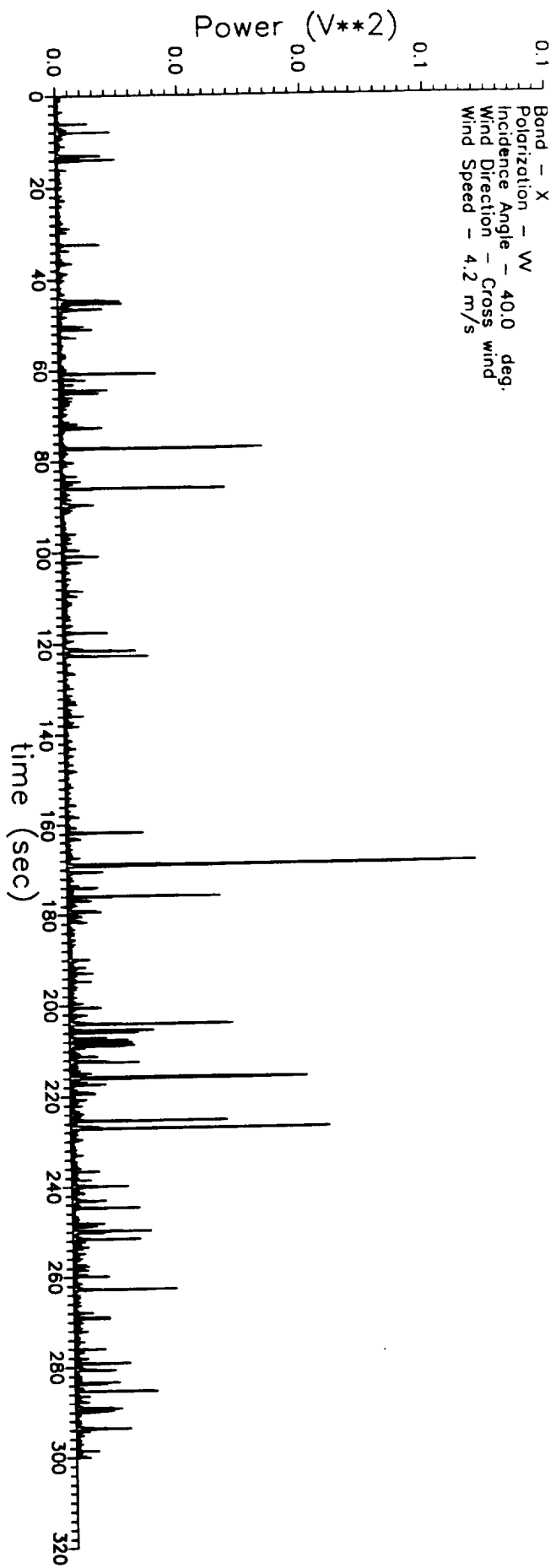
Run 35, 20:18, July 19, 1989

Band - X
Polarization - VV
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.5 m/s



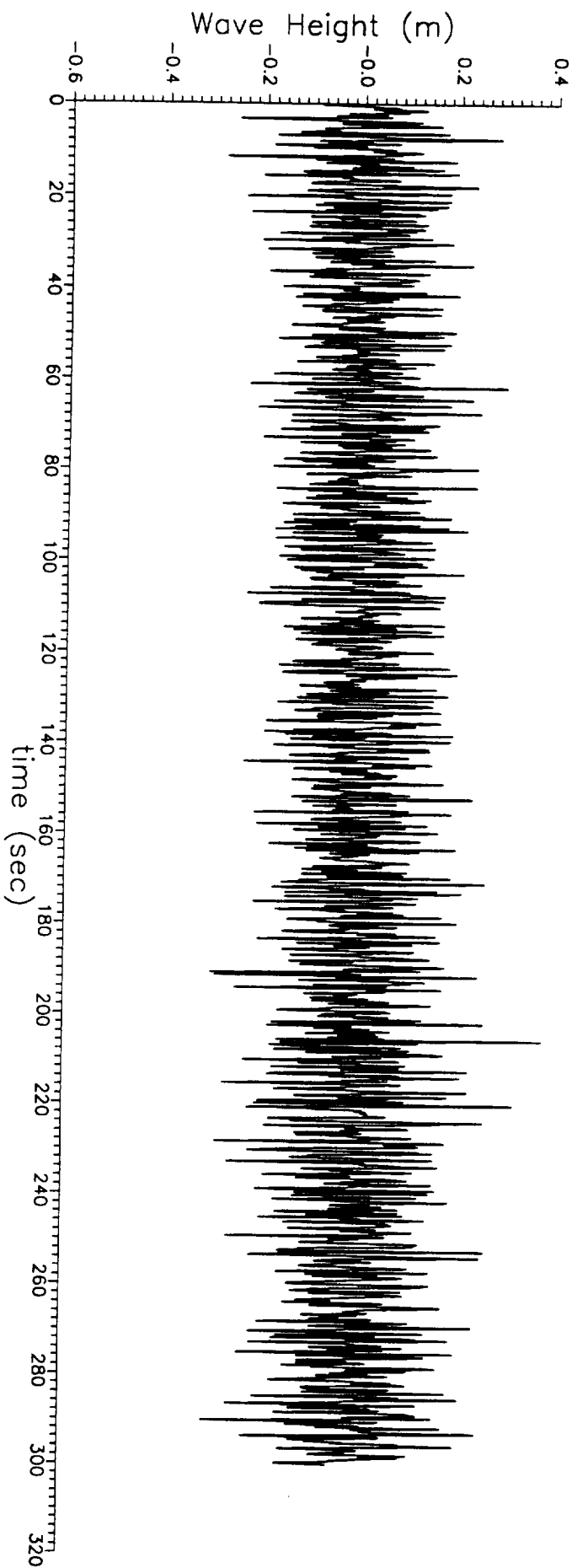
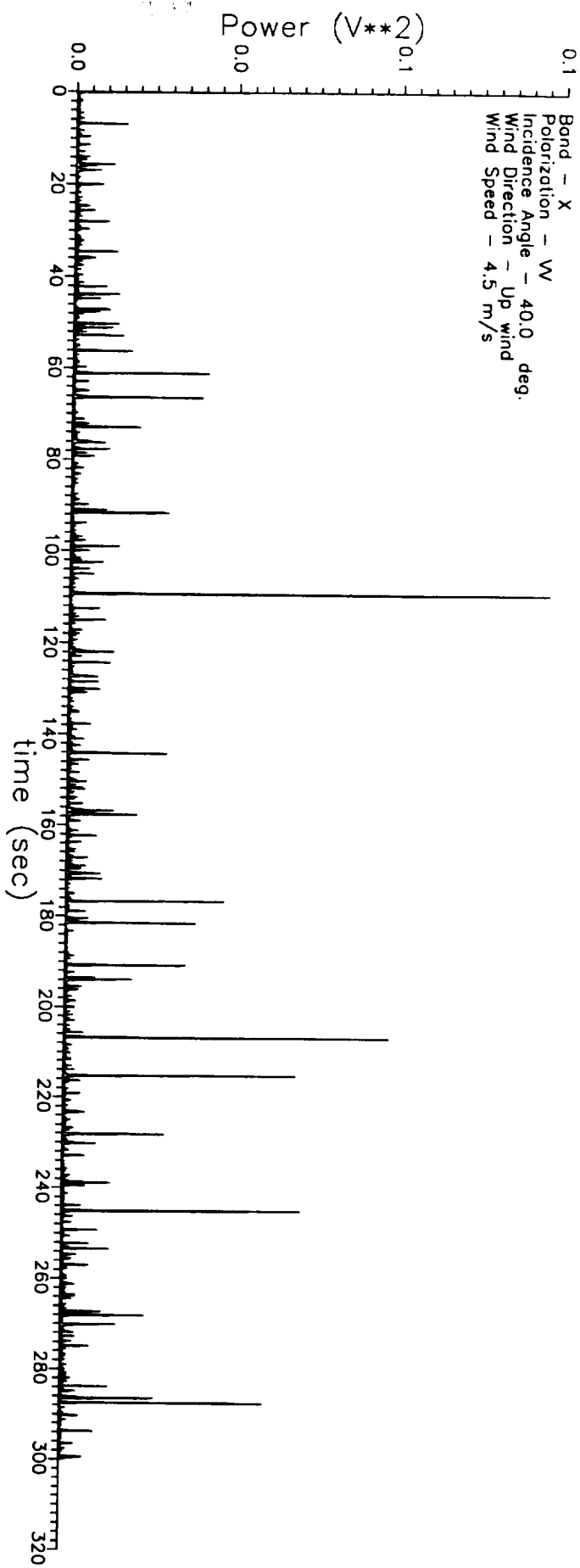
Run 36, 20:23, July 19, 1989

Bond - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.2 m/s



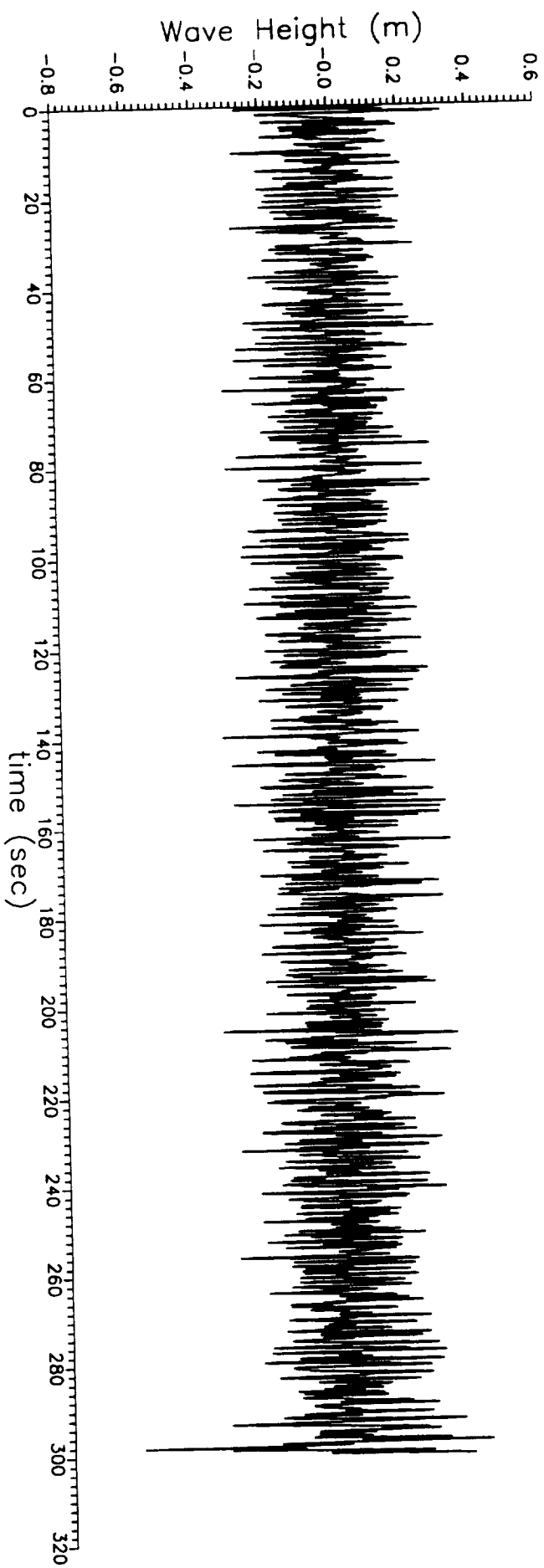
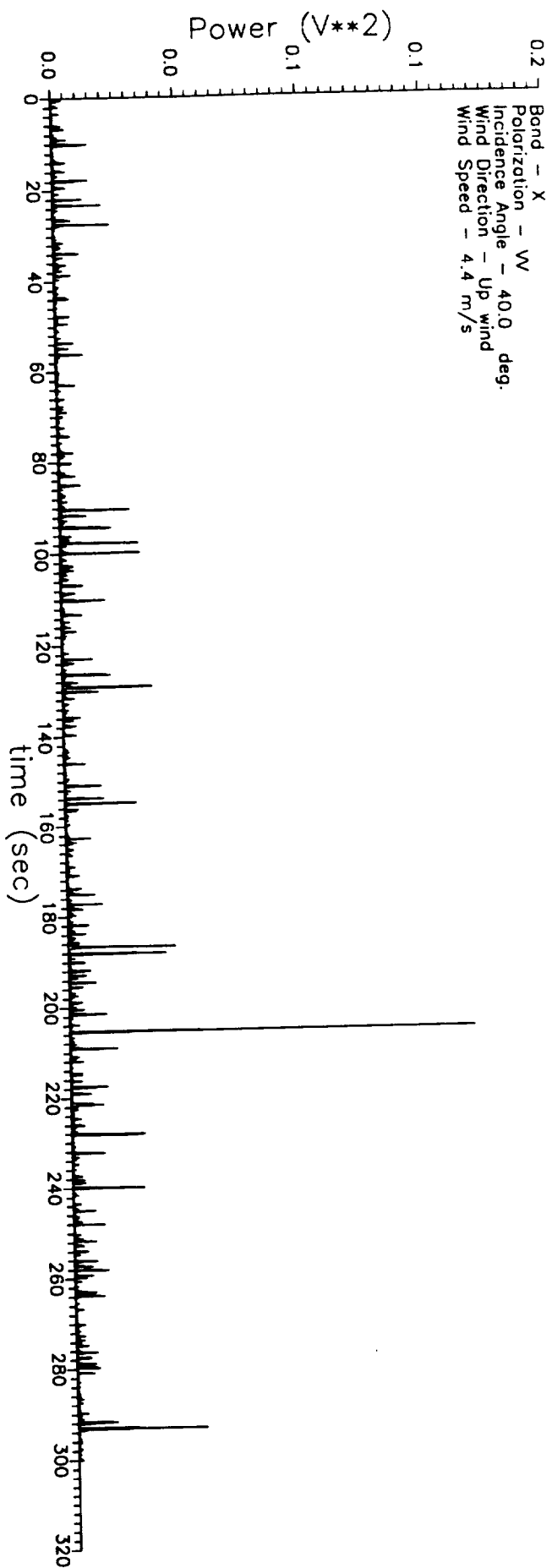
Run 9, 13:39, July 25, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.5 m/s



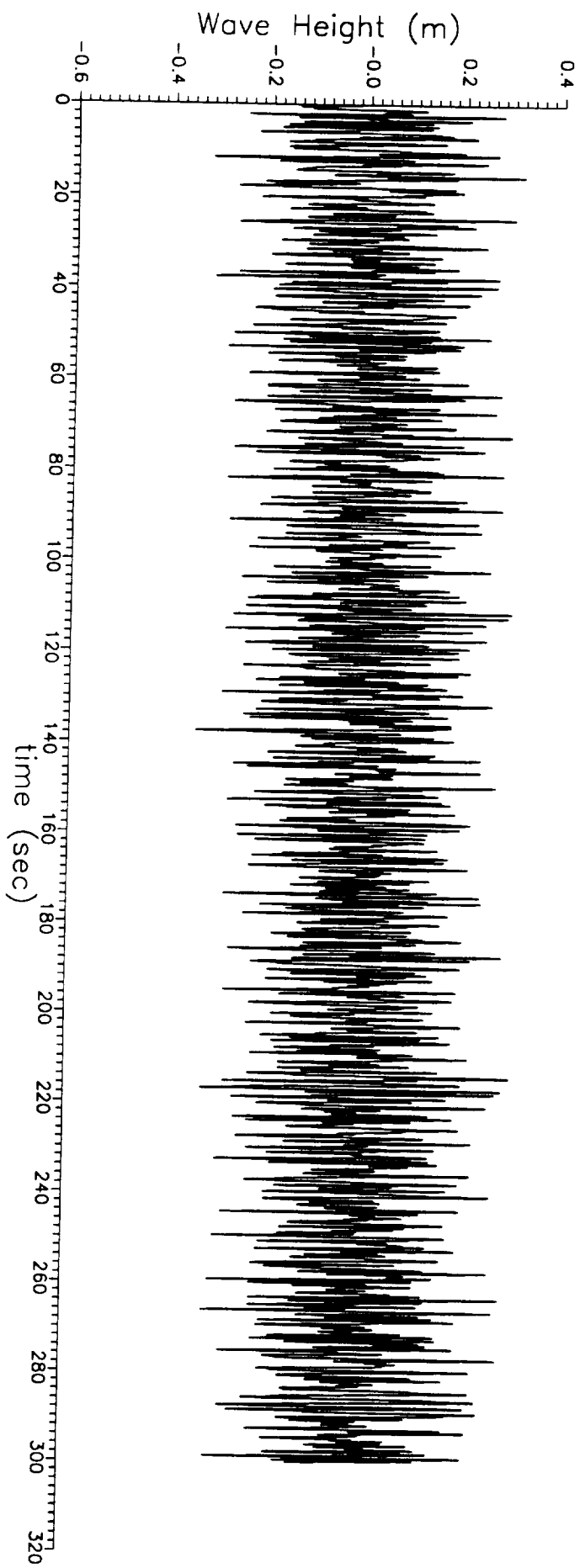
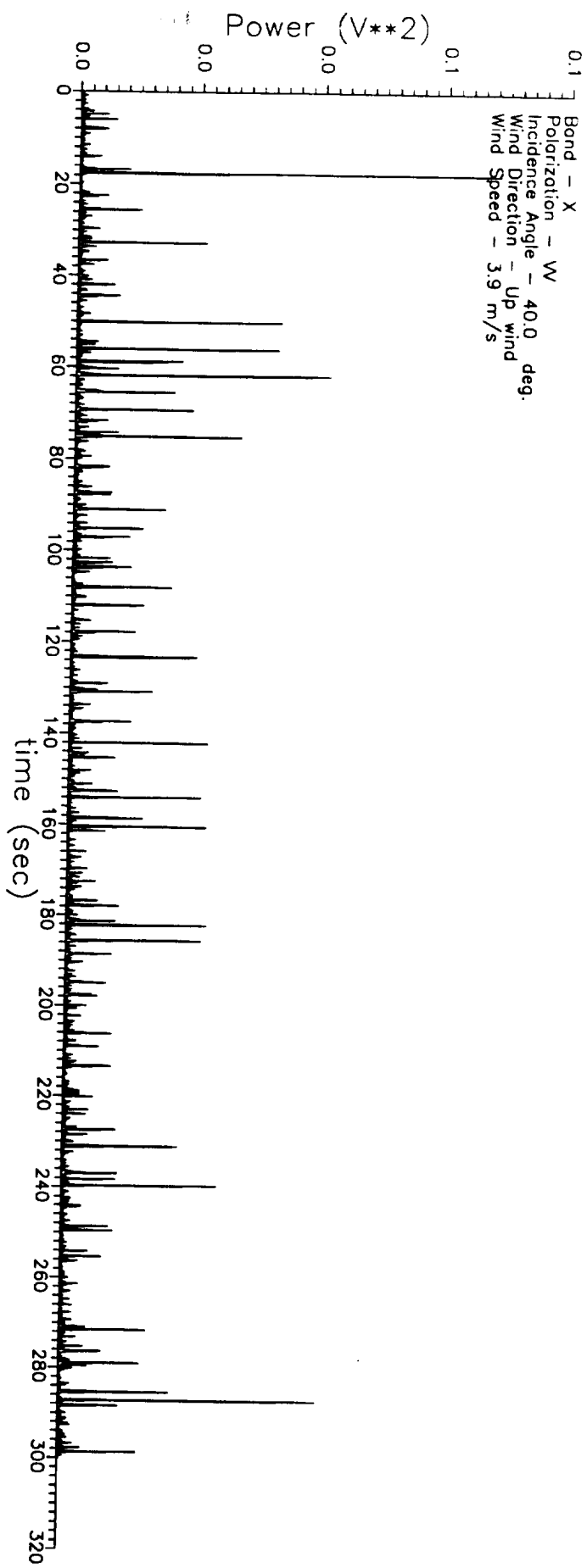
Run 12, 113:58, July 25, 198

Bond - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s

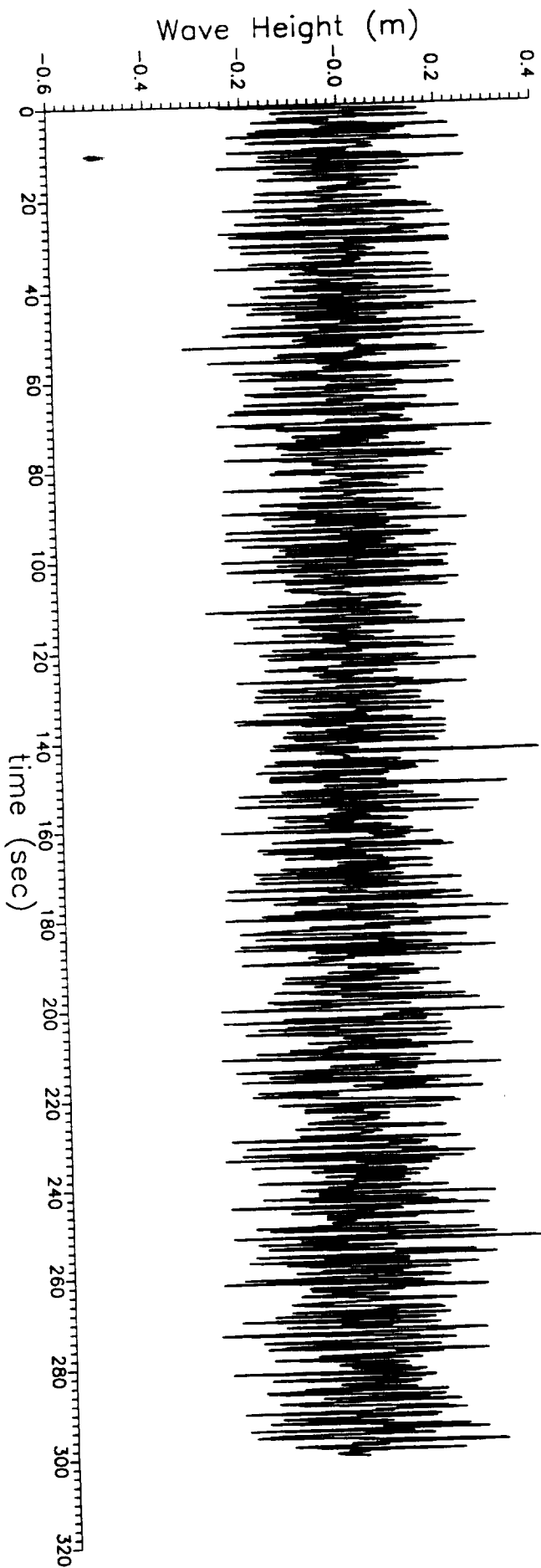
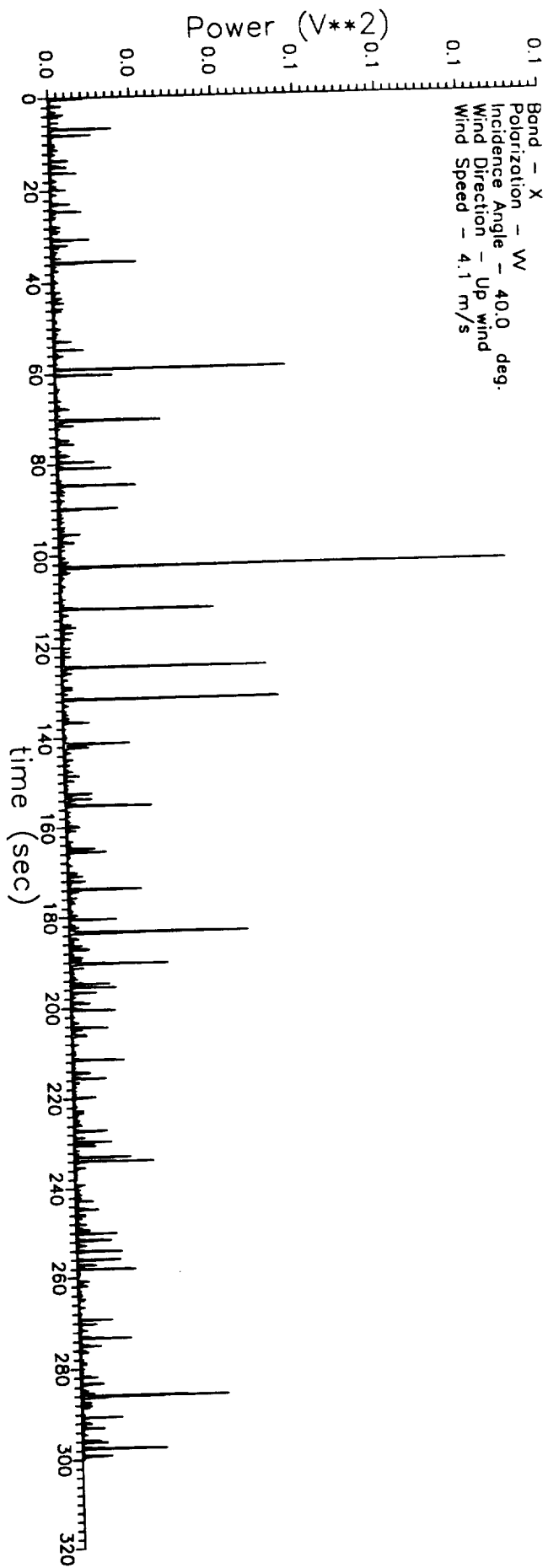


Run 13, 14:03, July 25, 1989

Bond - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s

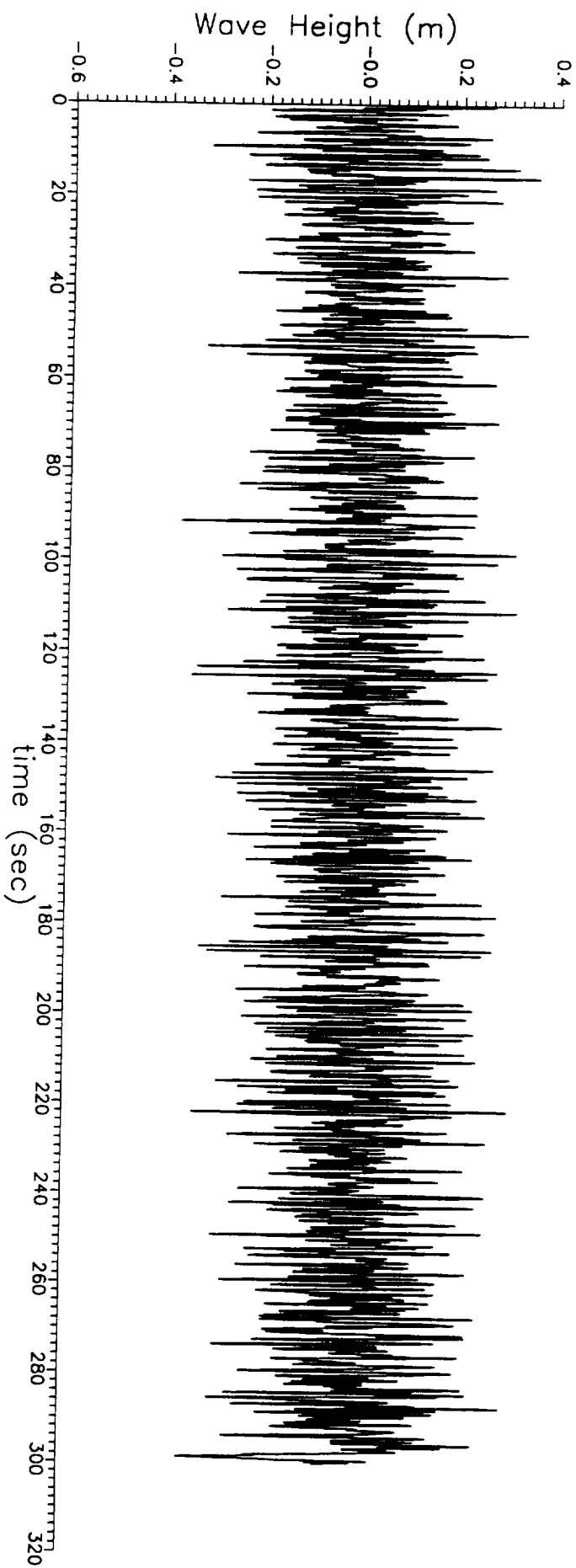
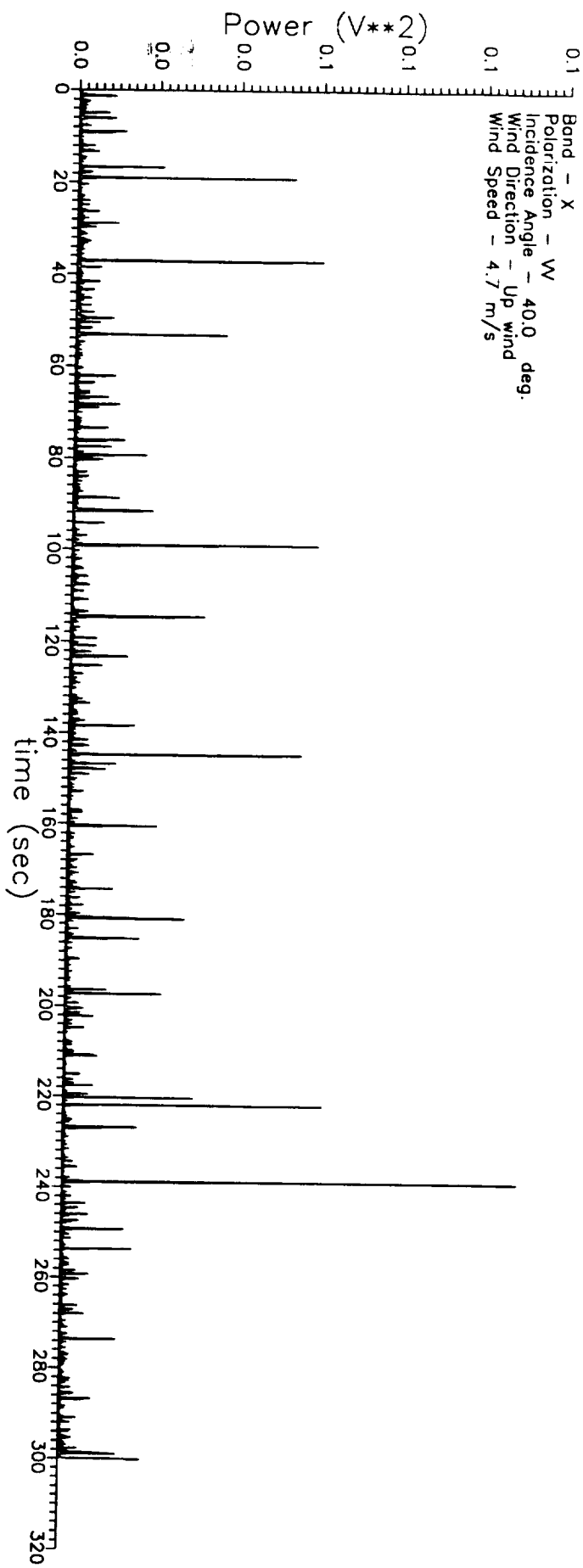


Run 14, 14:08, July 25, 1989

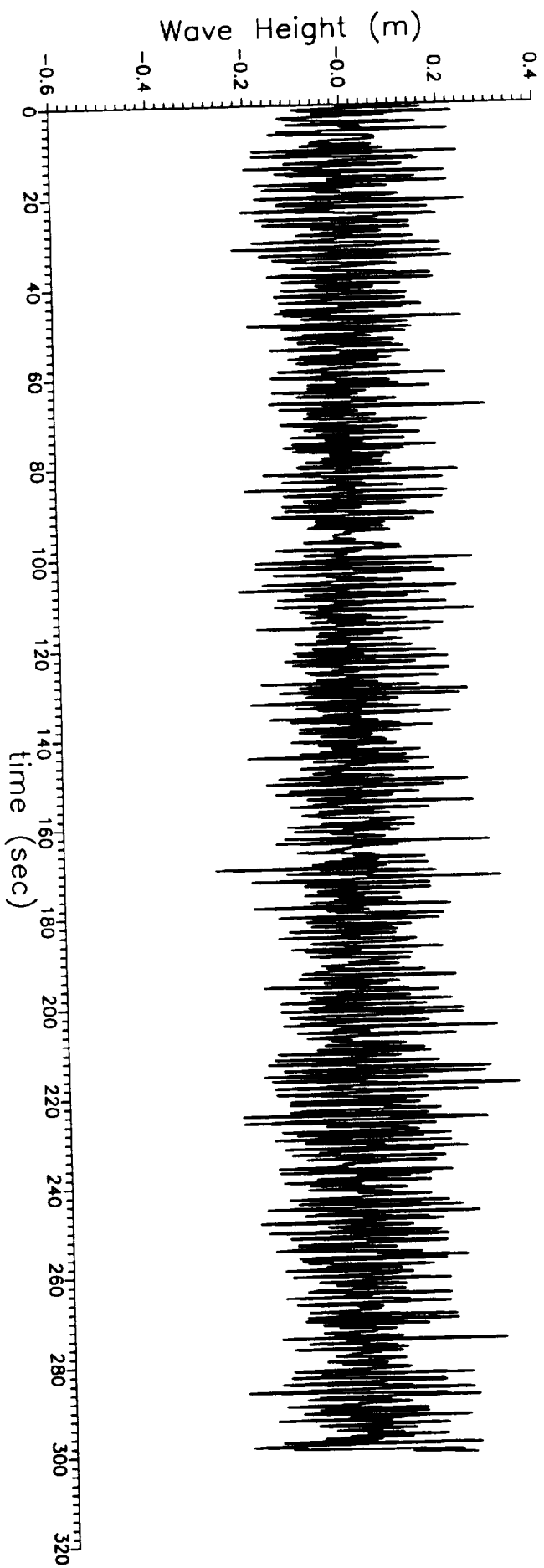
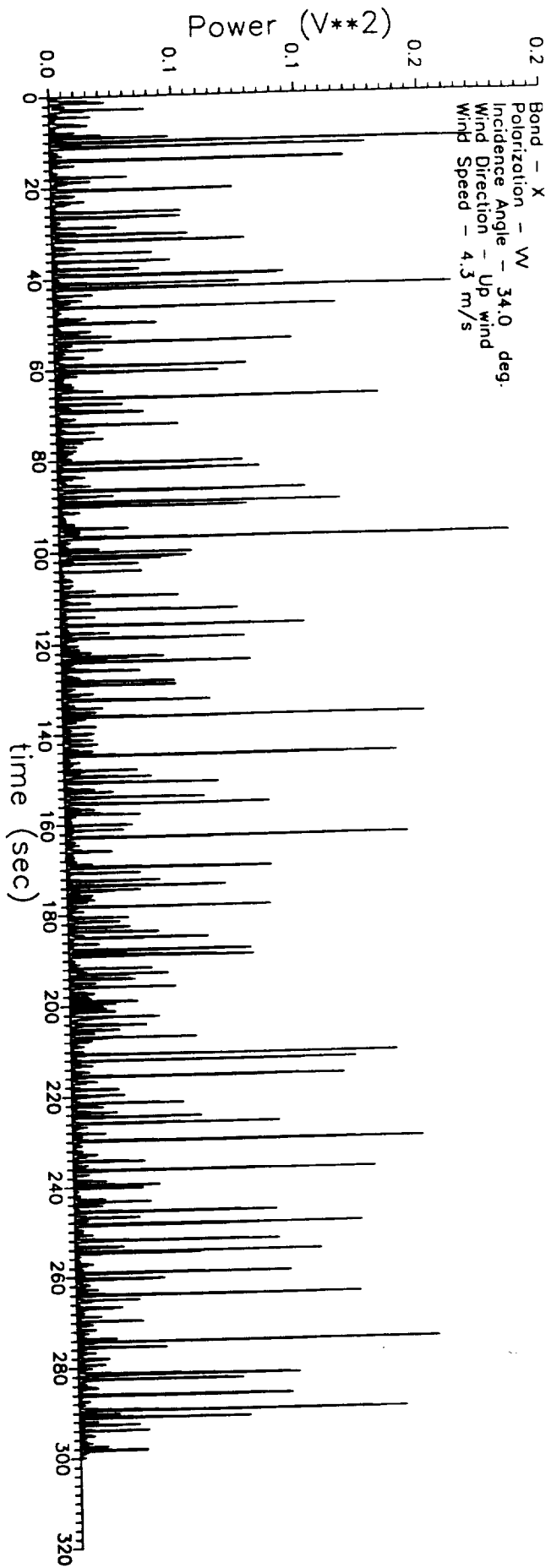


Run 16, 14:19, July 25, 1989

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.7 m/s

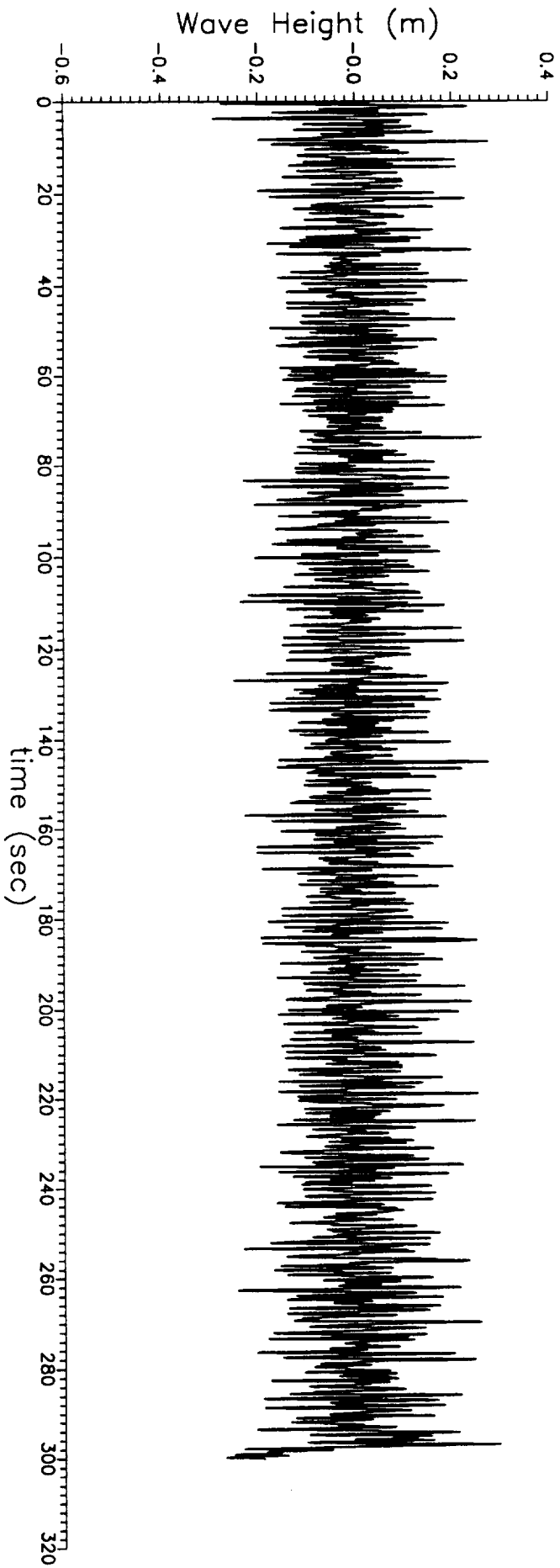
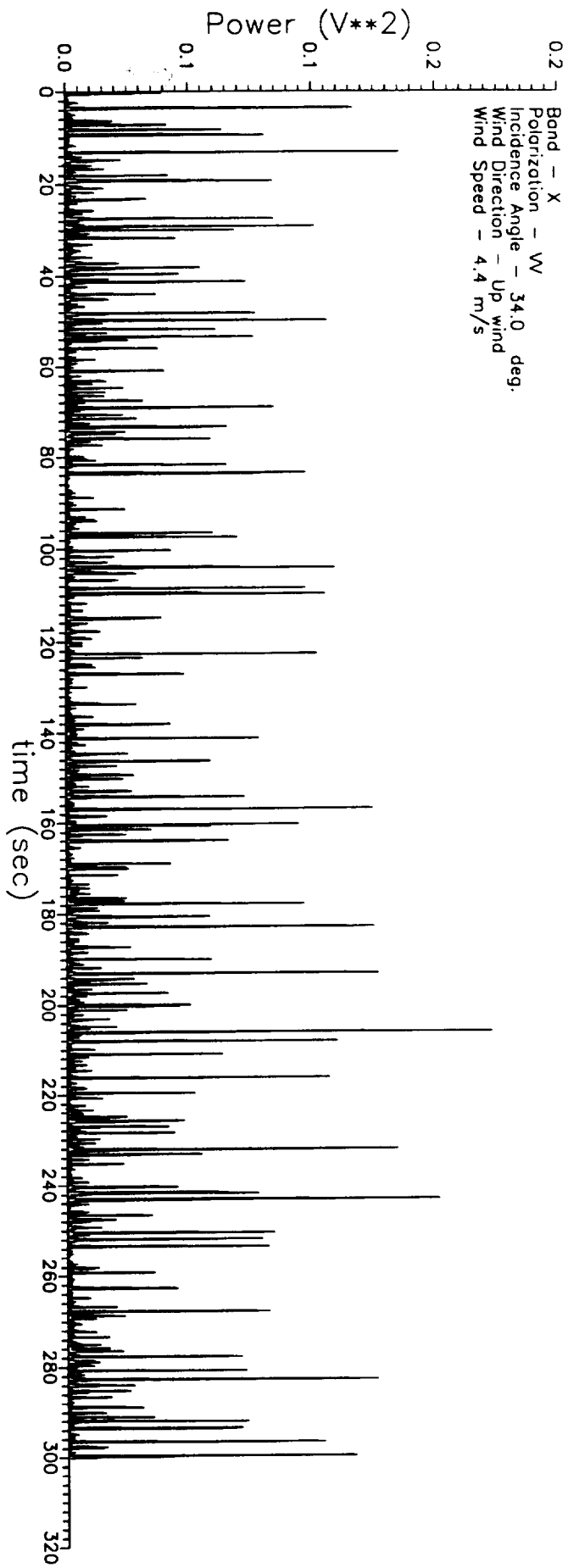


Run 7, 18:14, Aug 3, 1989

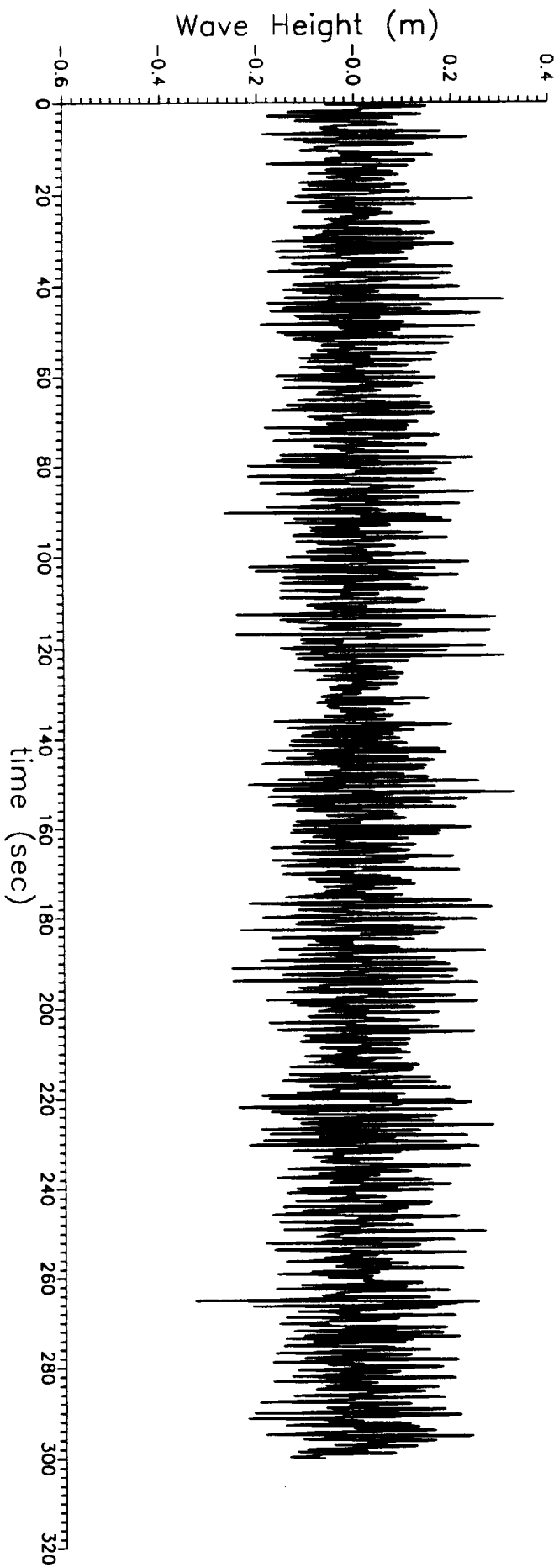
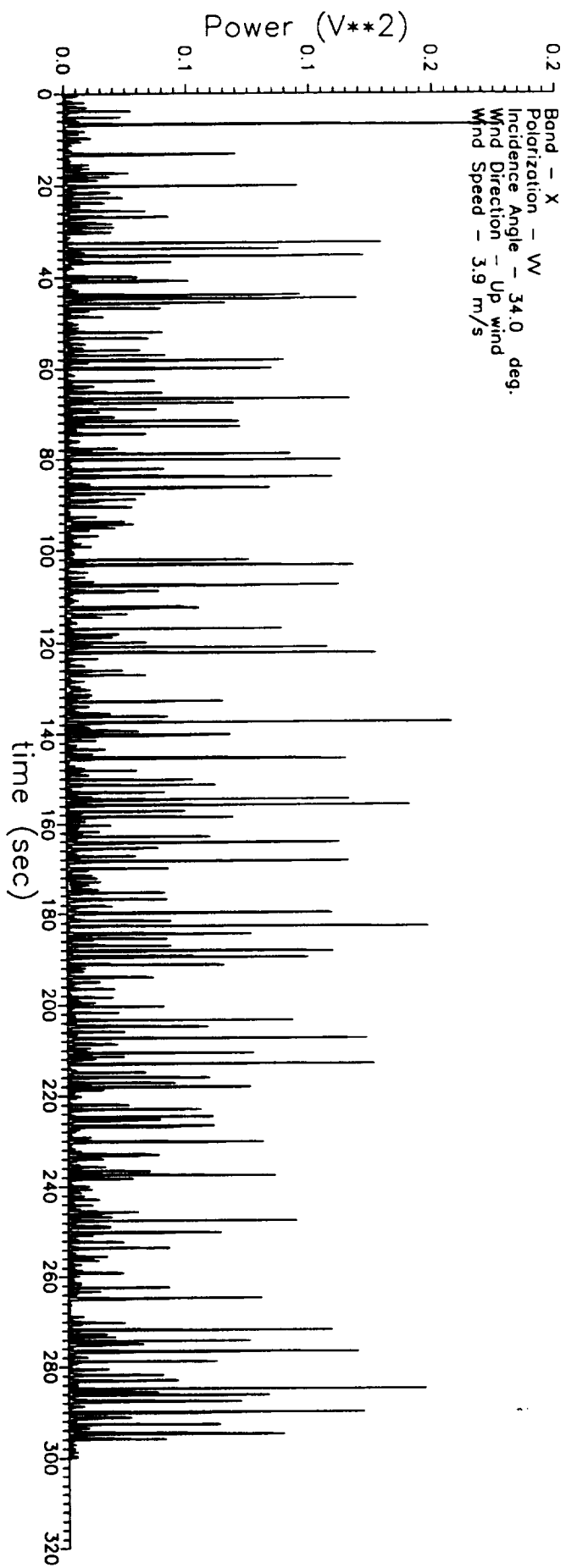


Run 9, 18:31, Aug 3, 1989

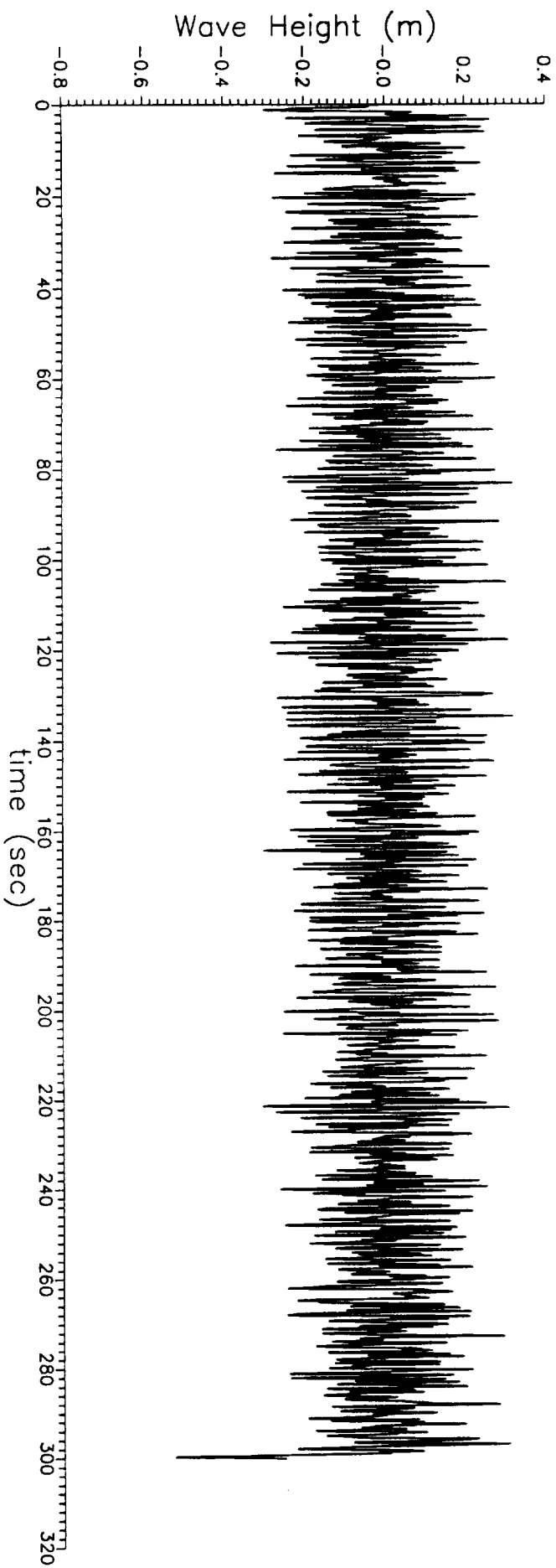
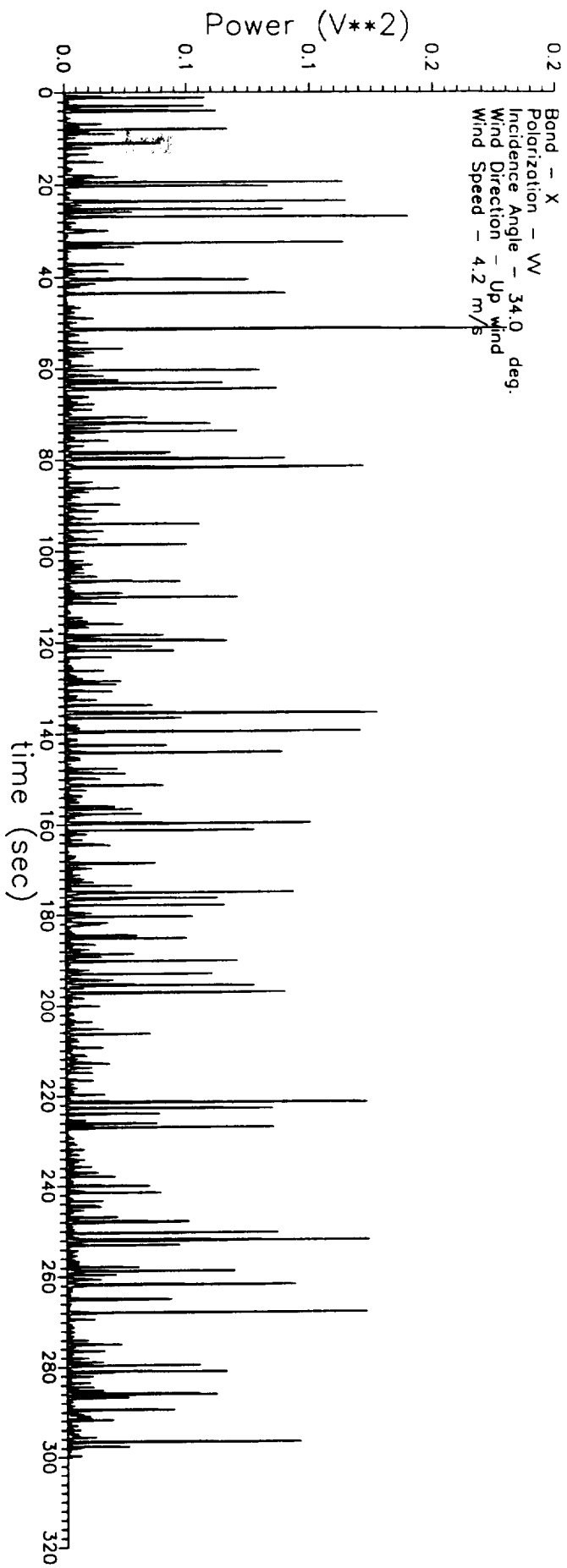
Band - X
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s



Run 10, 18:38, Aug 3, 1989

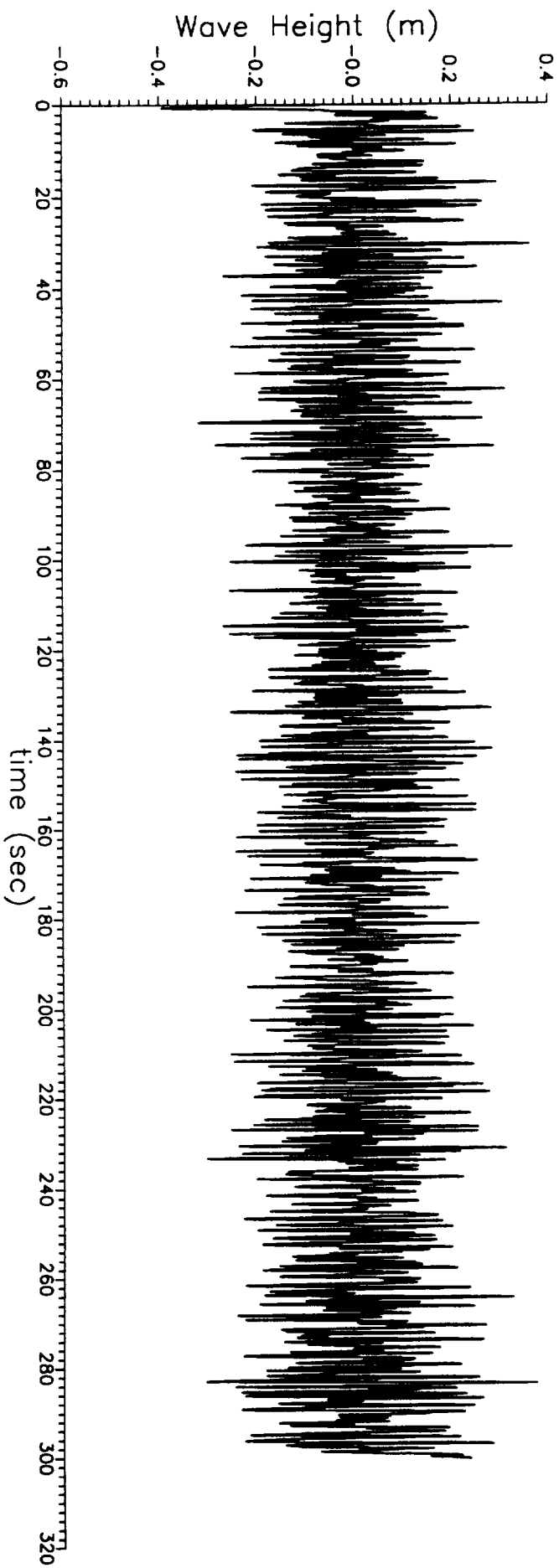
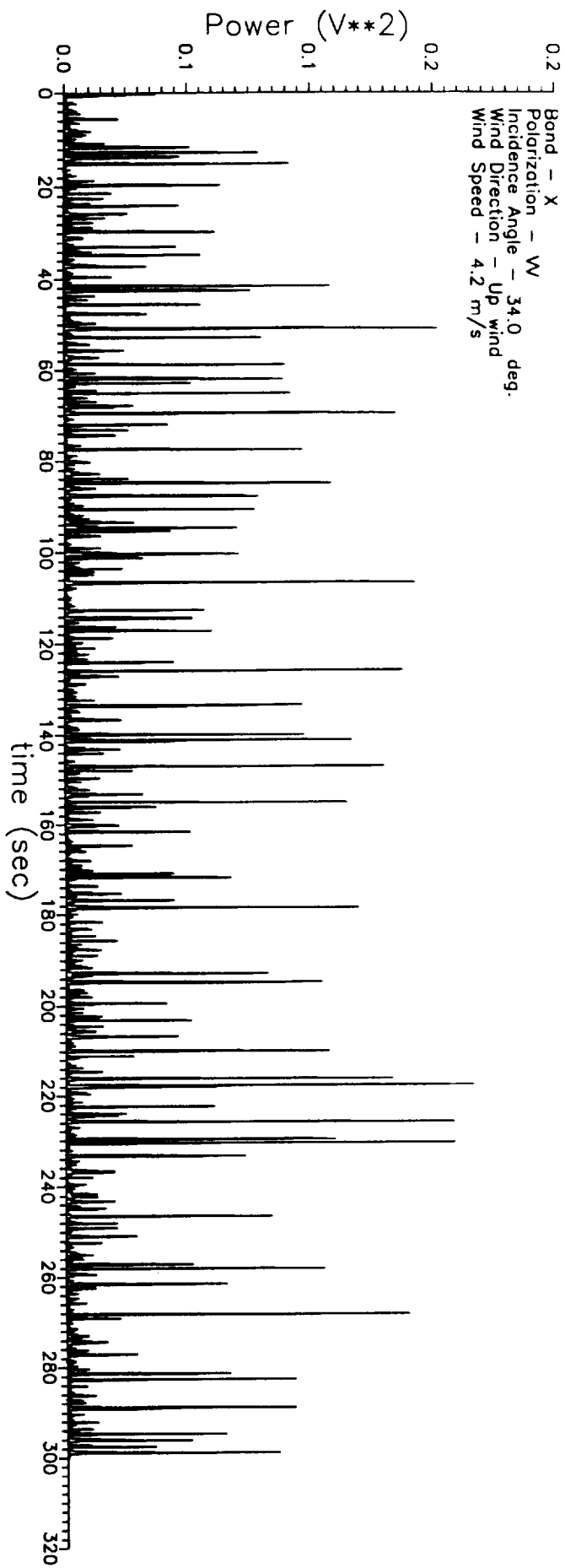


Run 14, 19:25, Aug 3, 1989

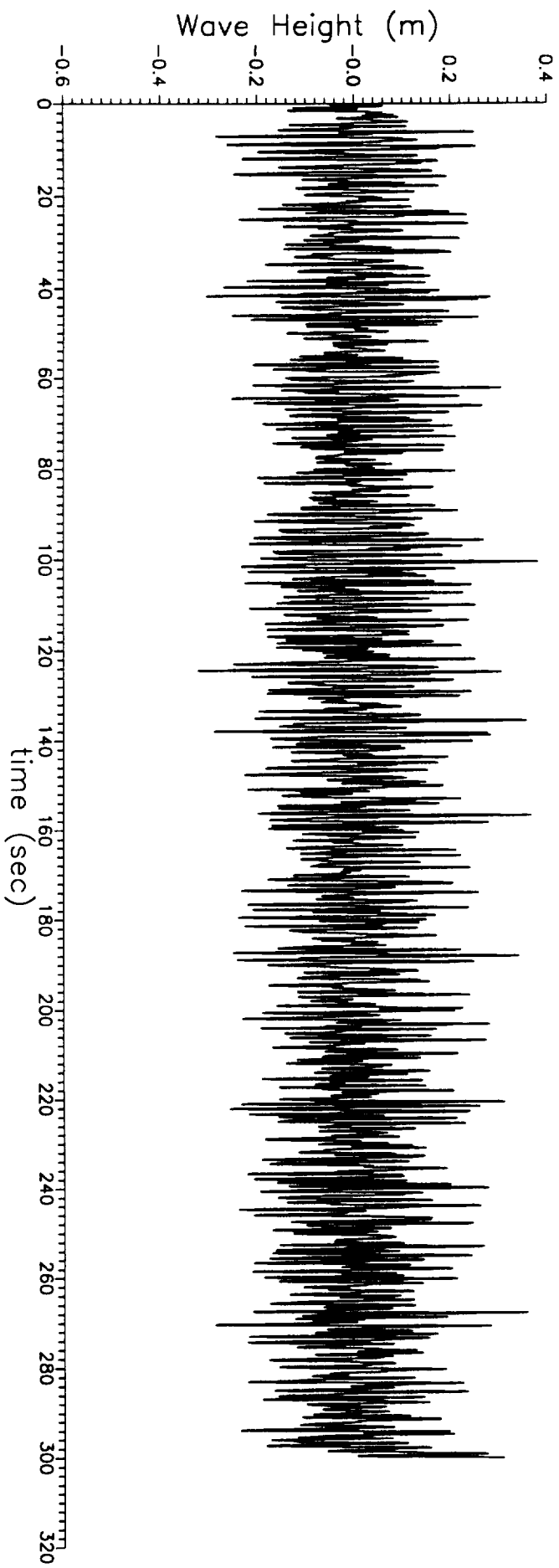
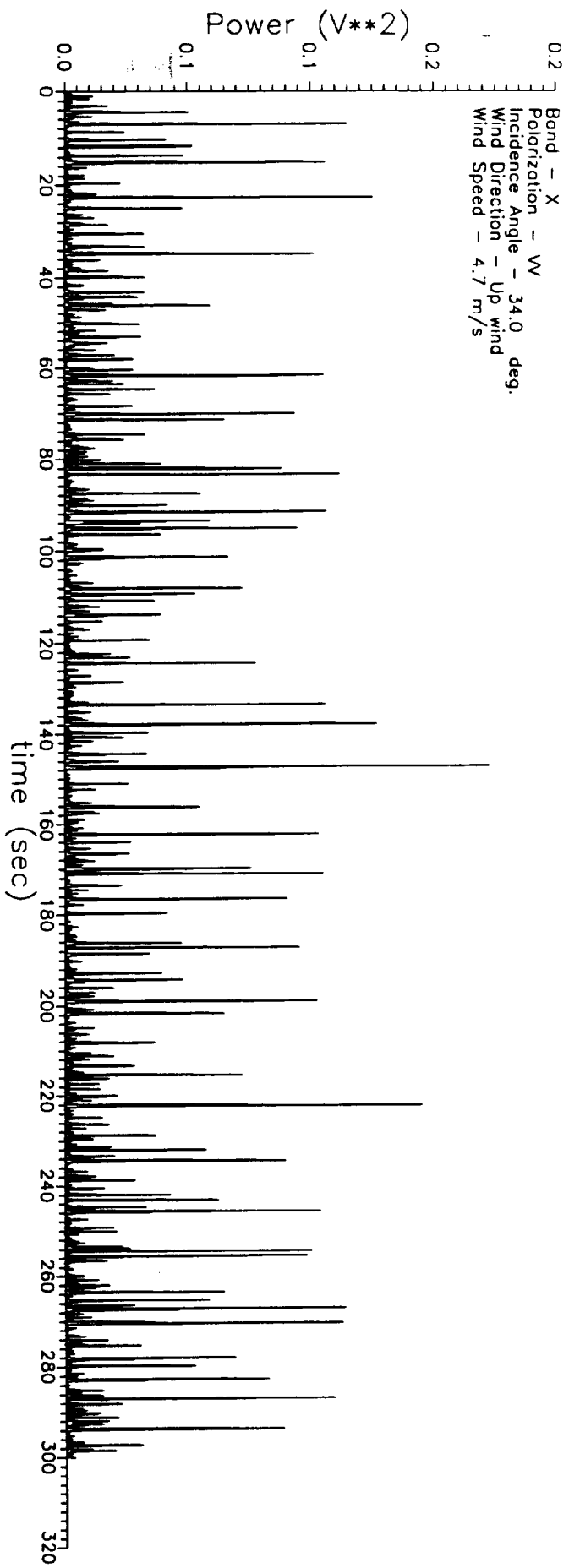


Run 15, 19:31, Aug 3, 1989

Band - X
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s

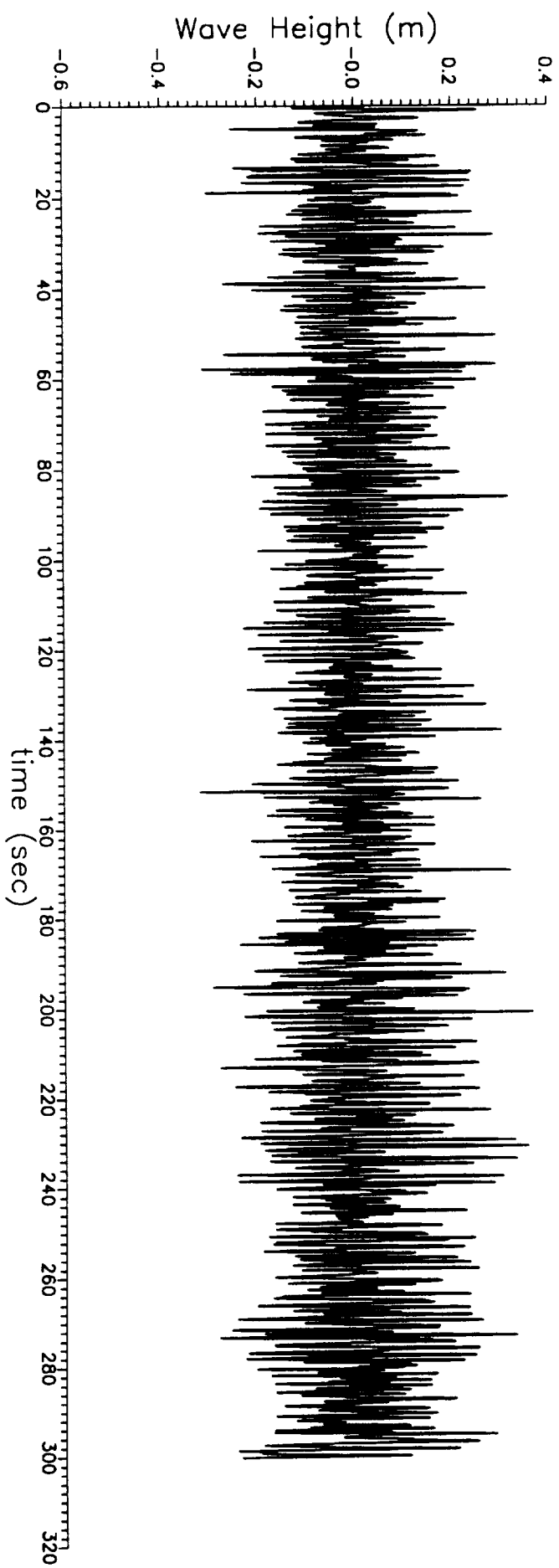
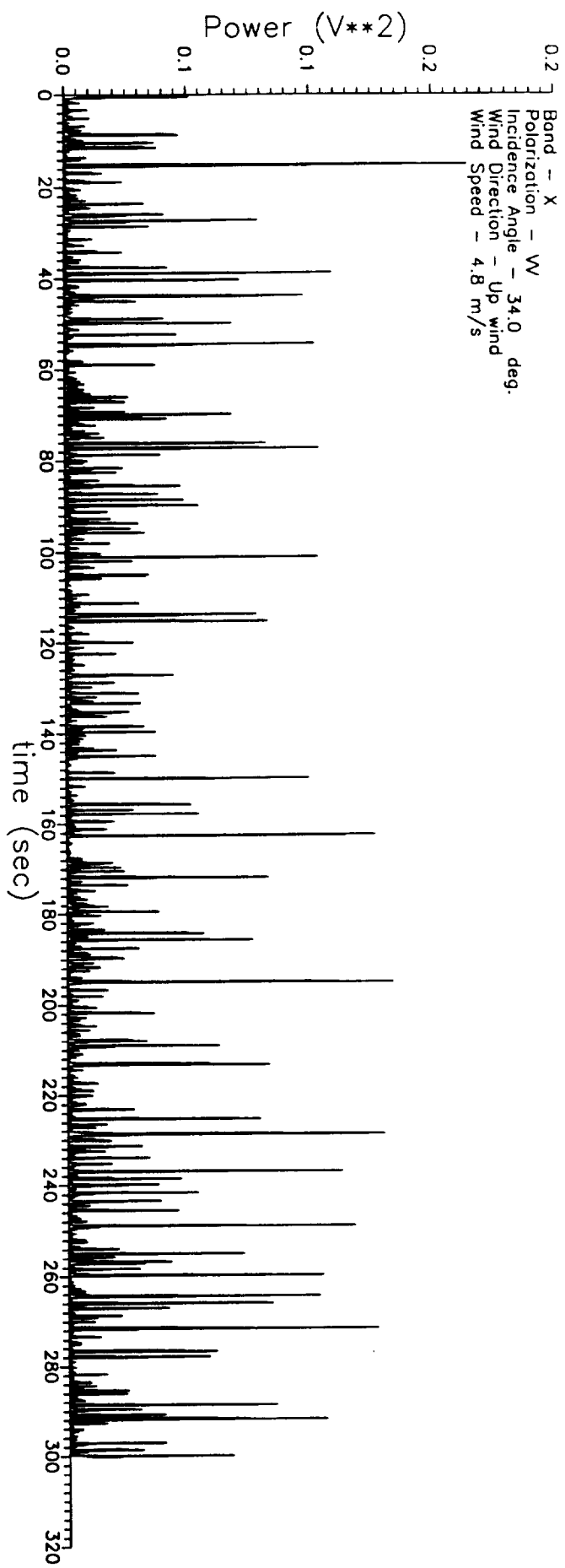


Run 16, 19:37, Aug 3, 1989

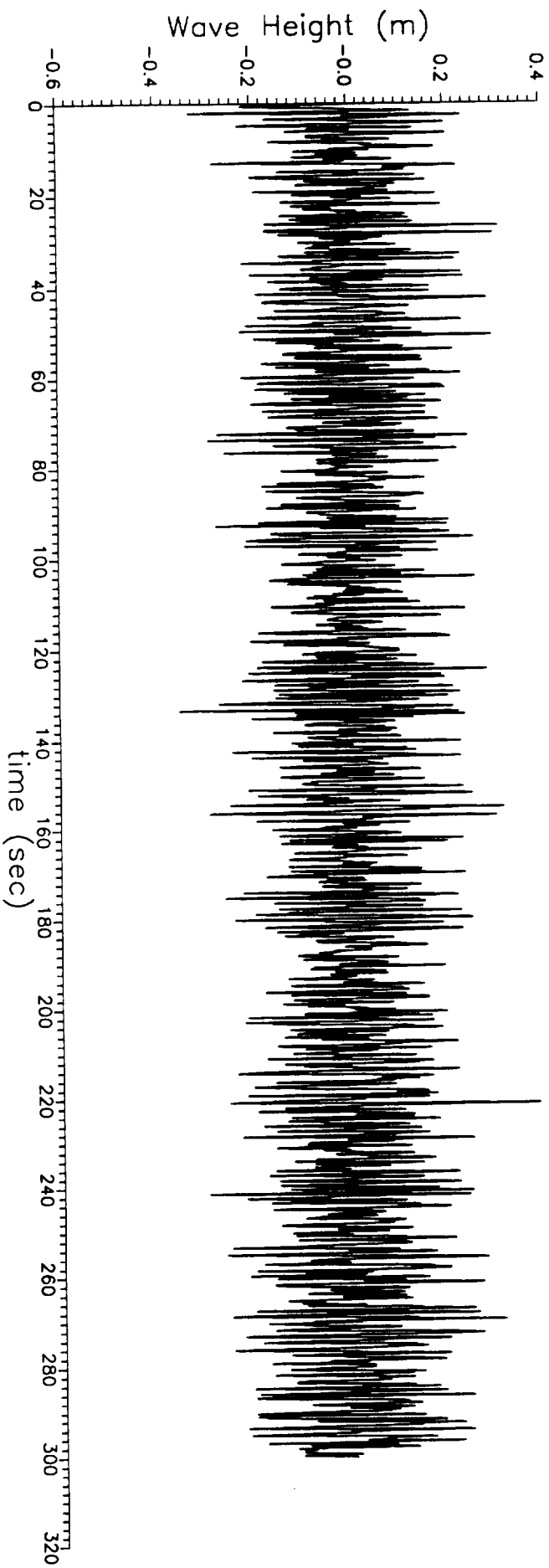
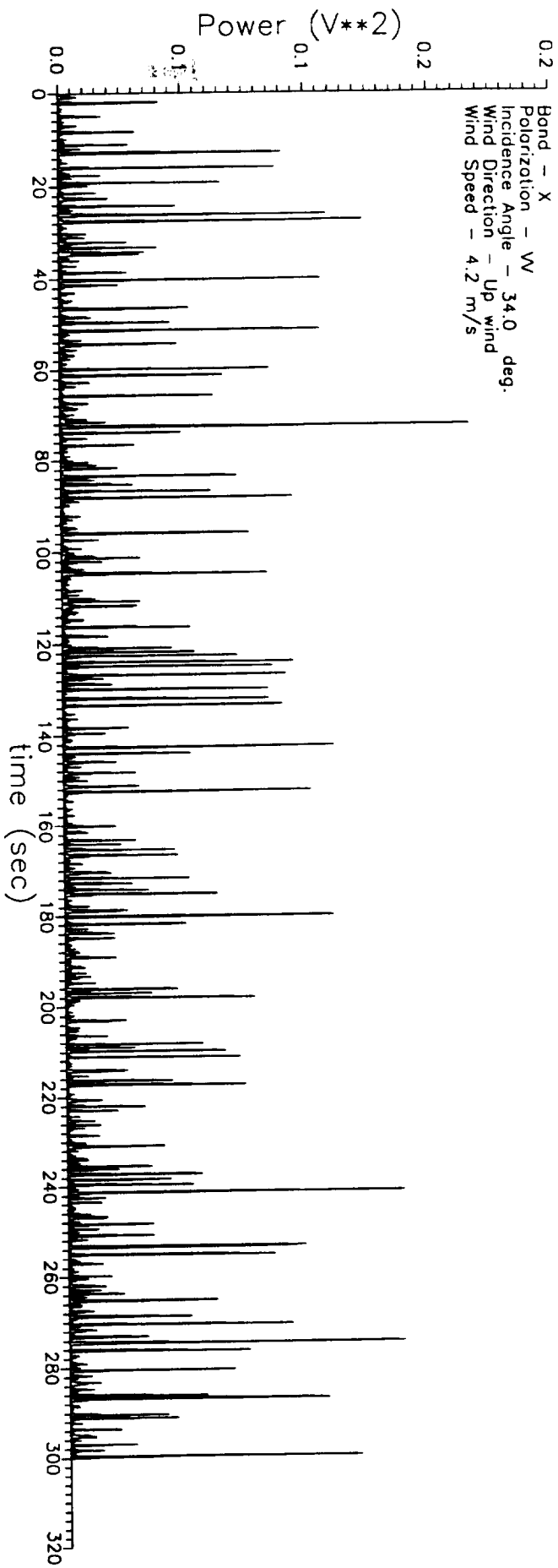


Run 17, 19:42, Aug 3, 1989

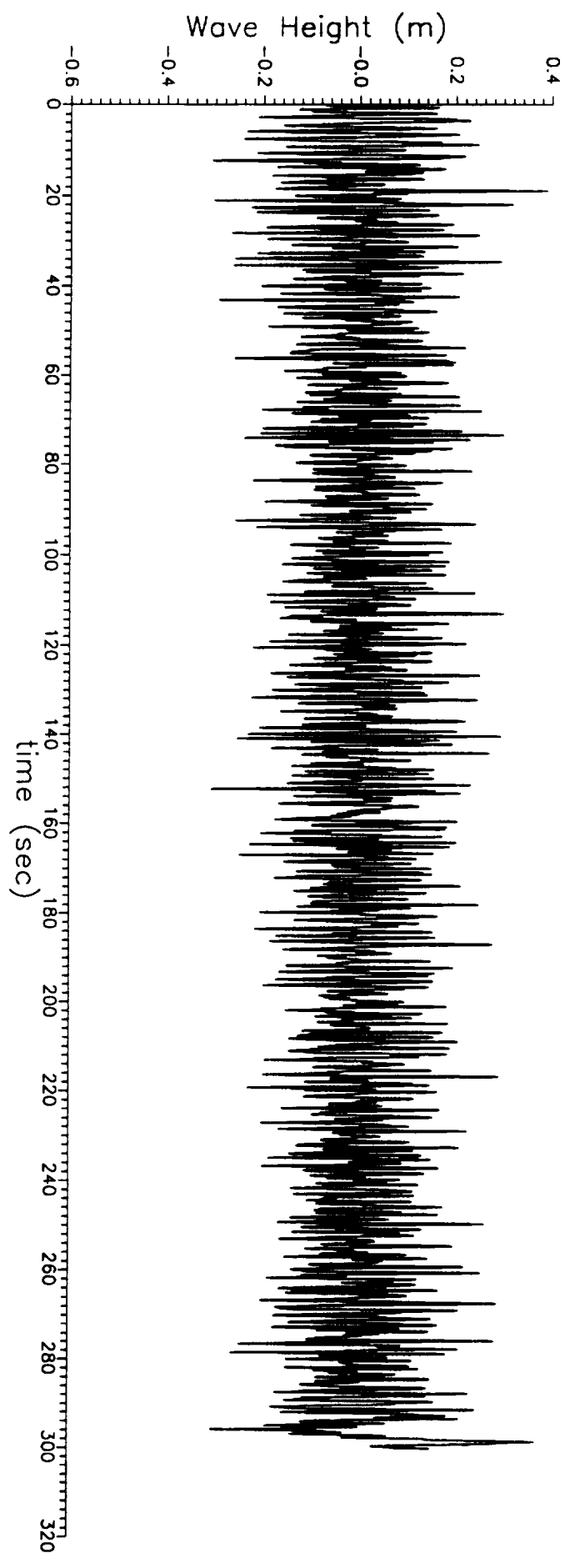
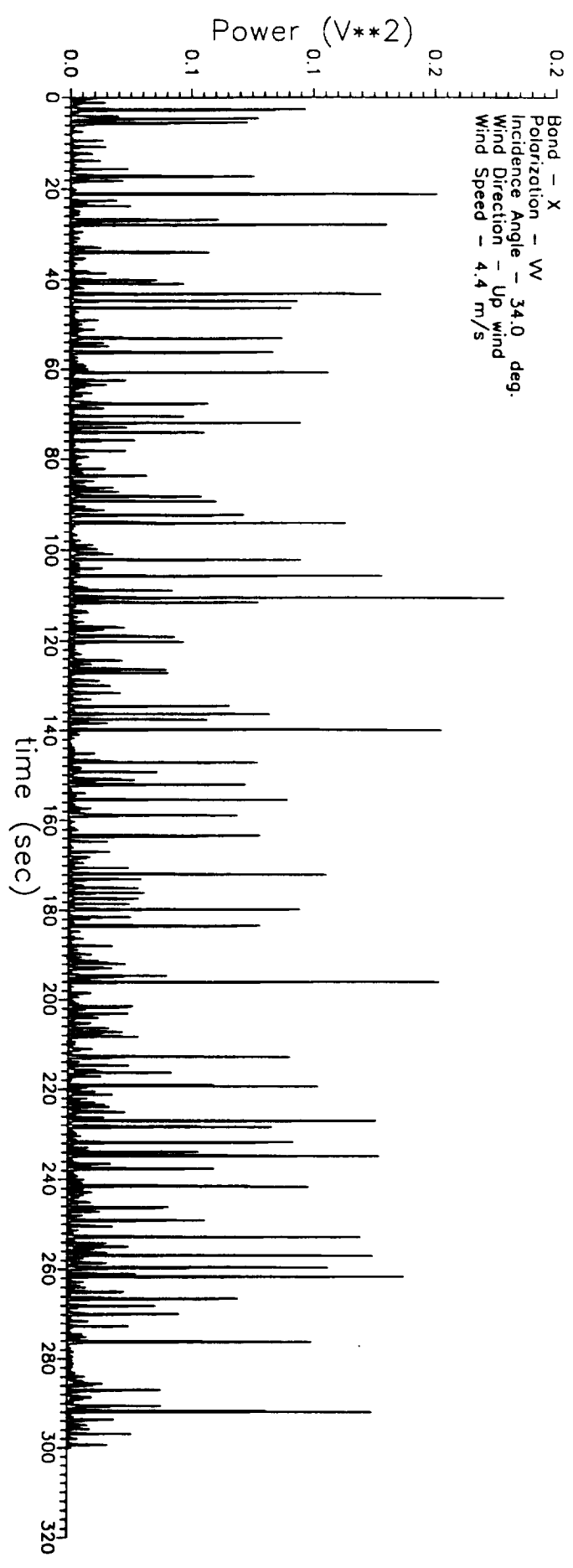
Band - X
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s



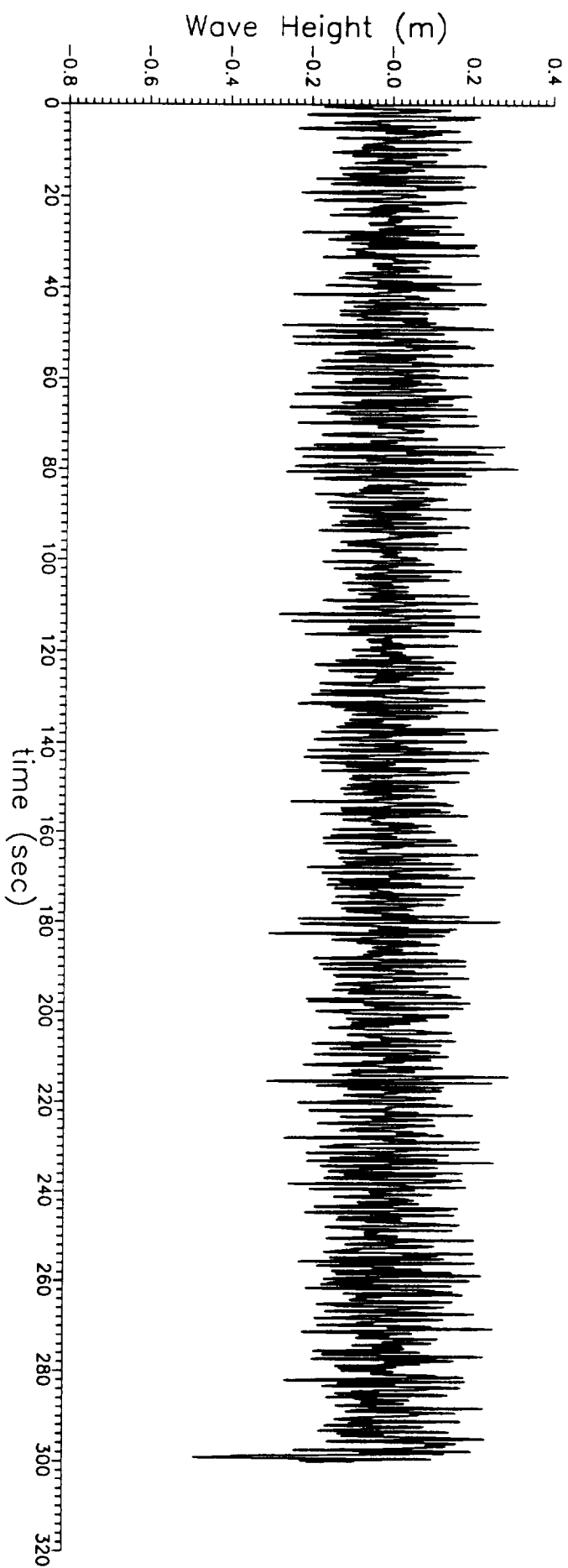
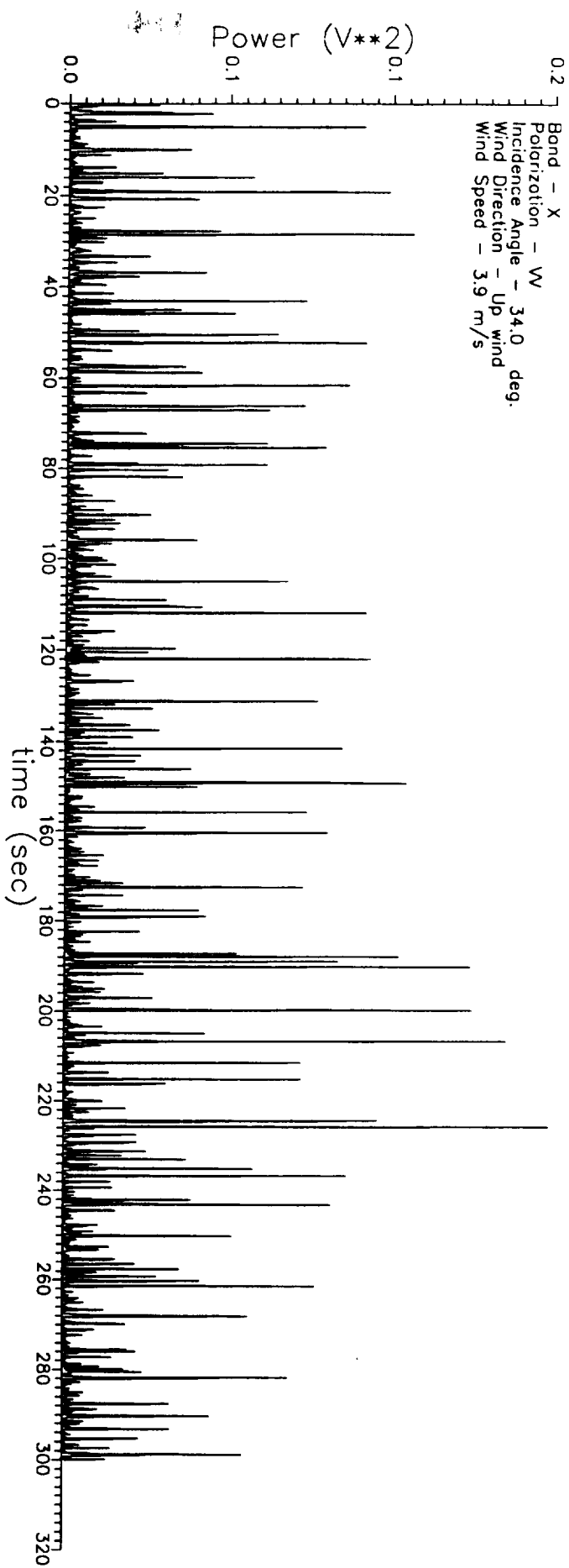
Run 18, 19:48, Aug 3, 1989



Run 19, 19:54, Aug 3, 1989

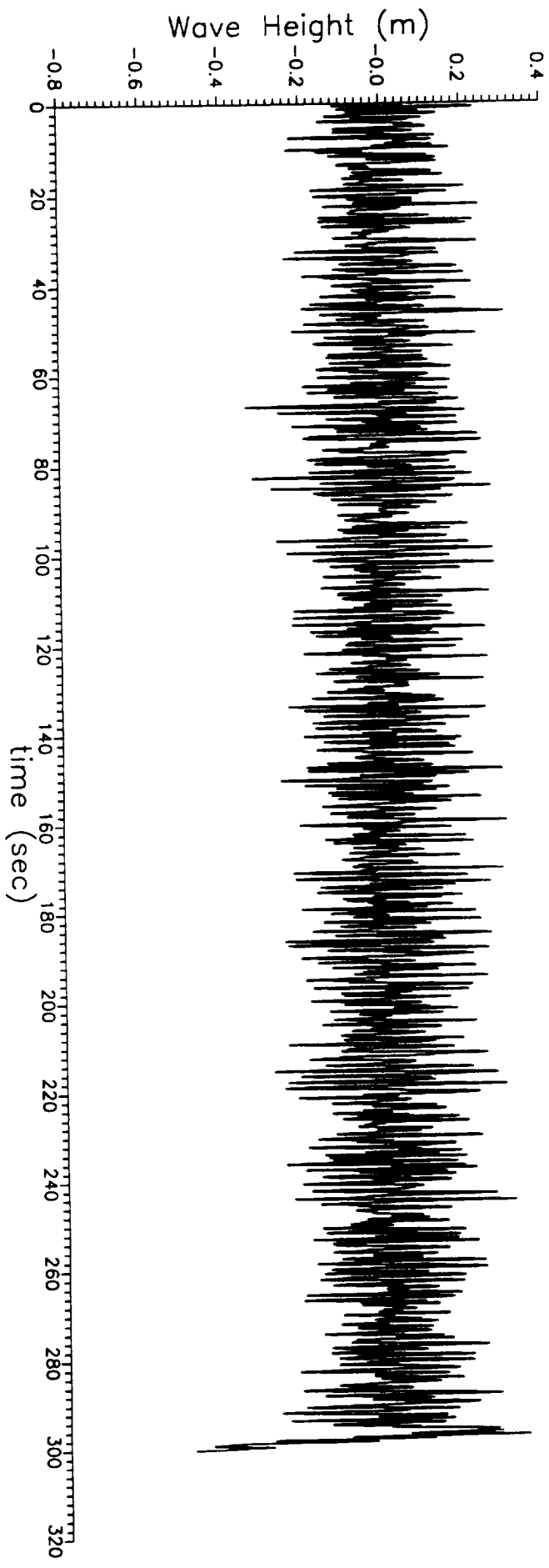
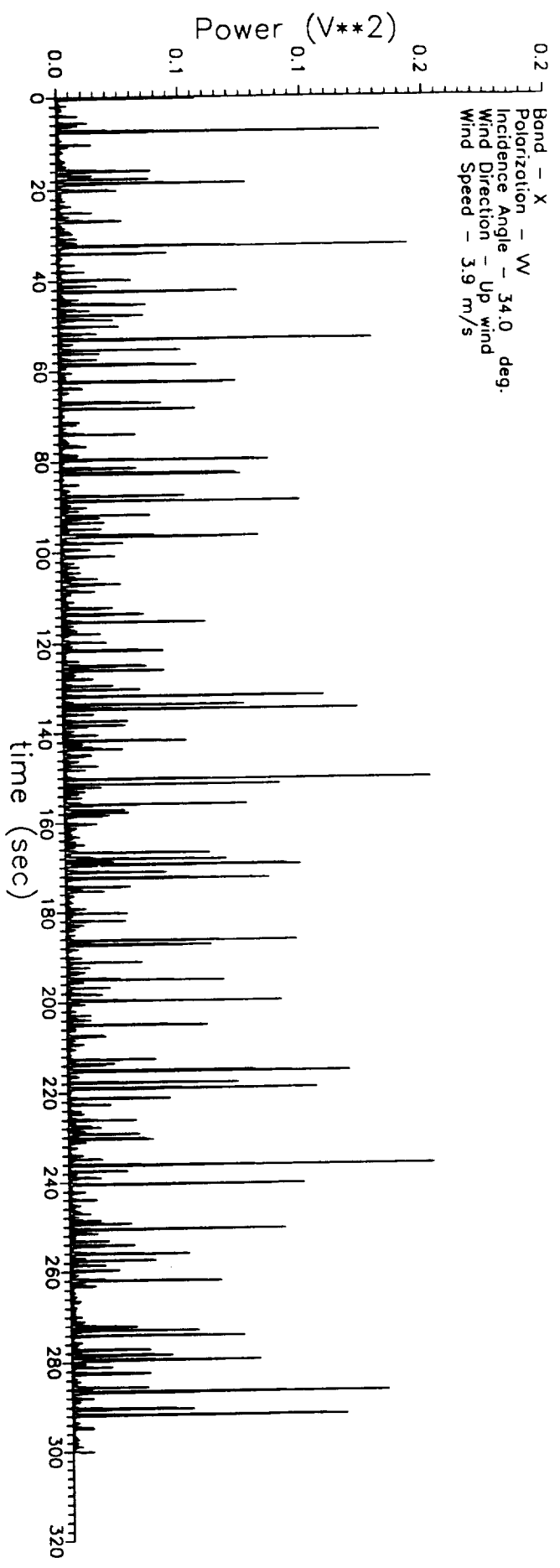


Run 20, 19:59, Aug 3, 1989



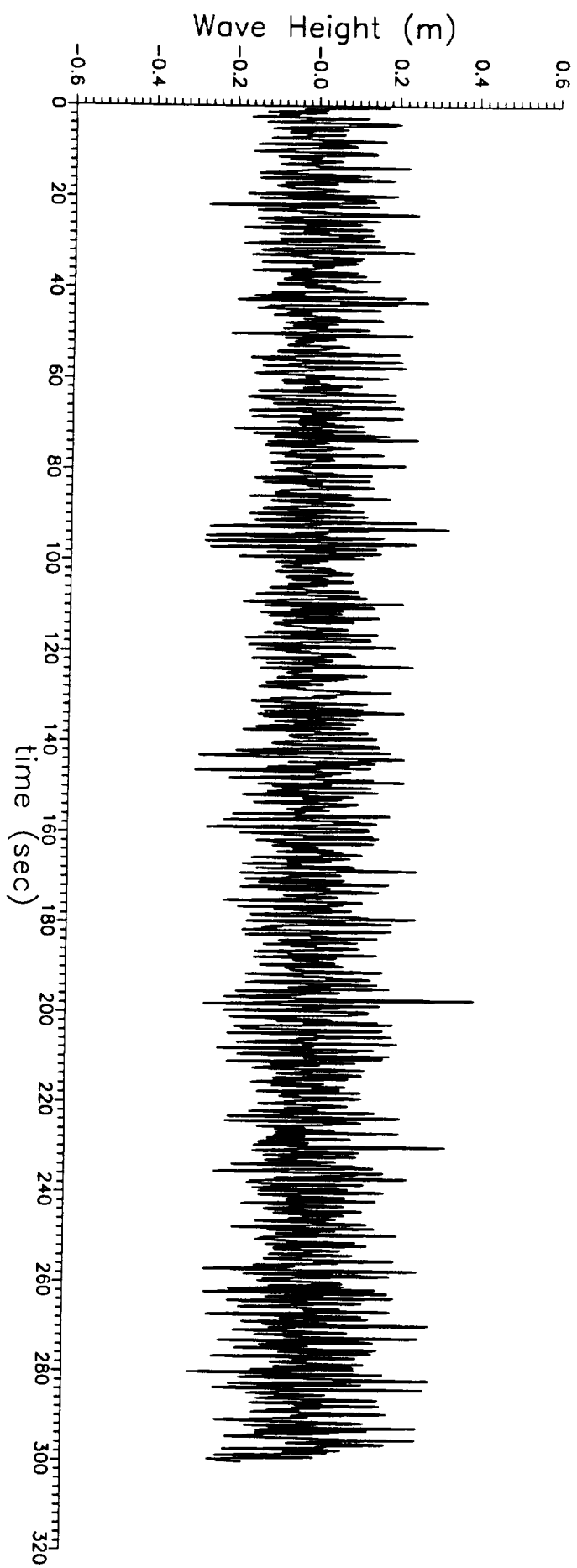
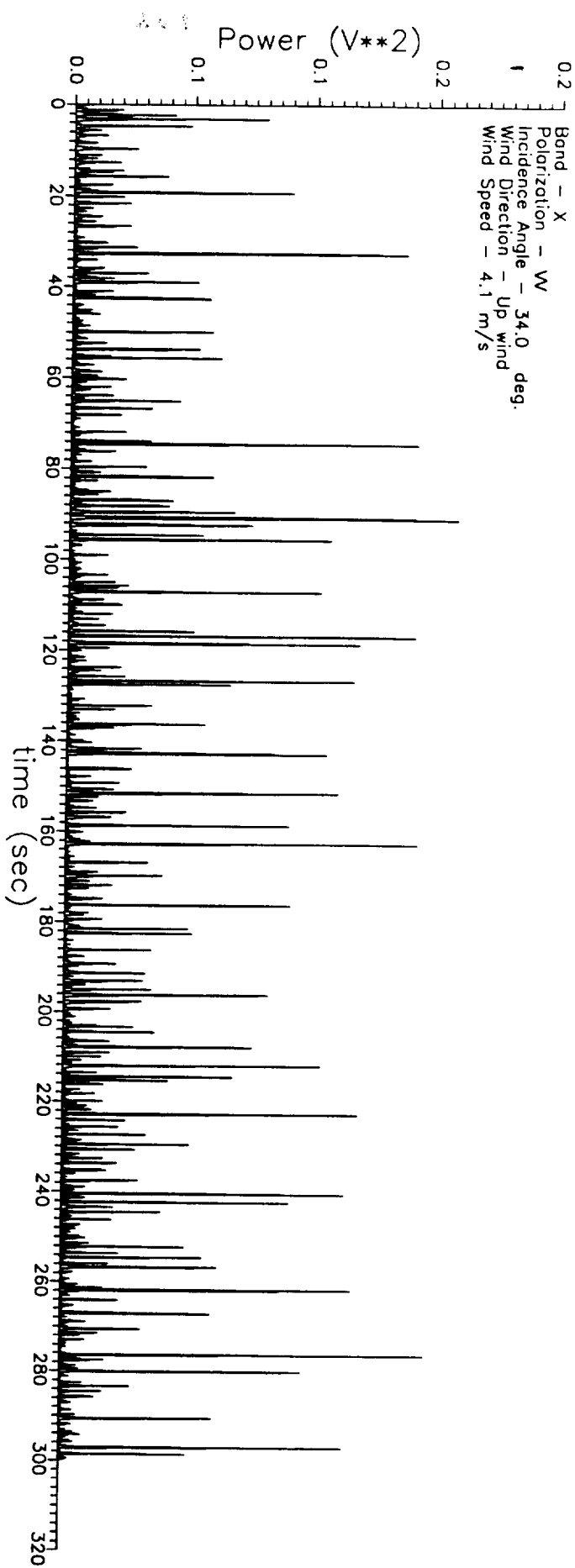
Run 21, 20:05, Aug 3, 1989

Band - X
Polarization - V
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s



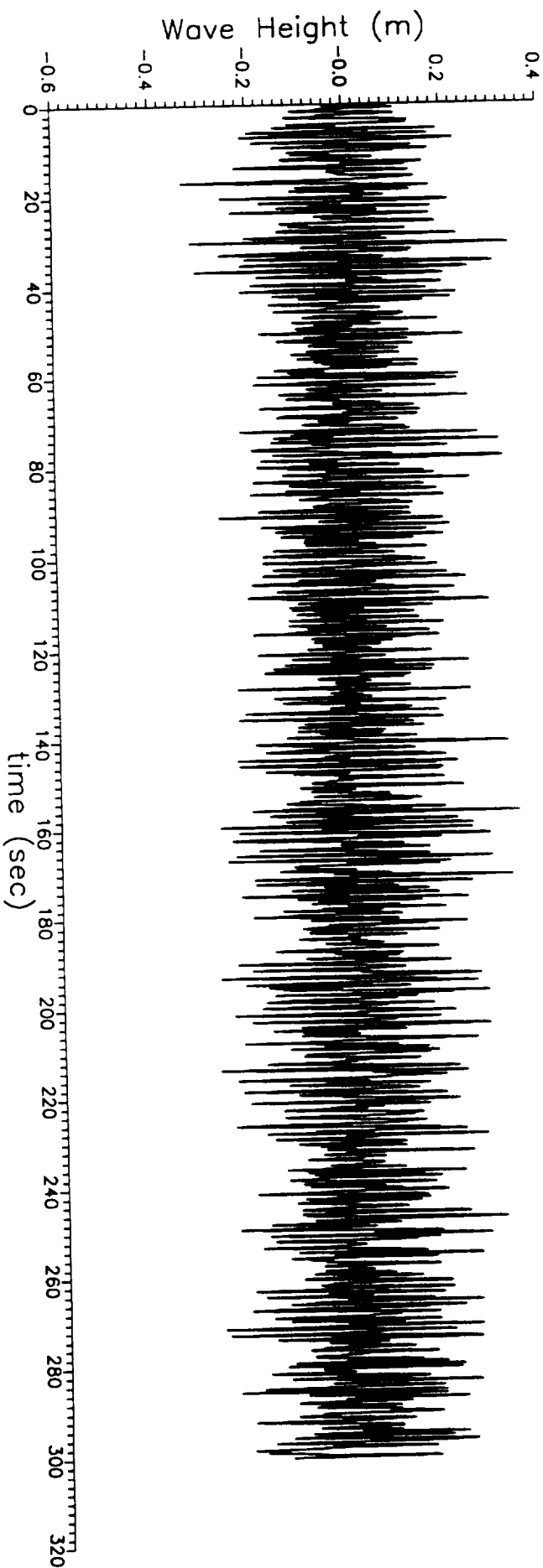
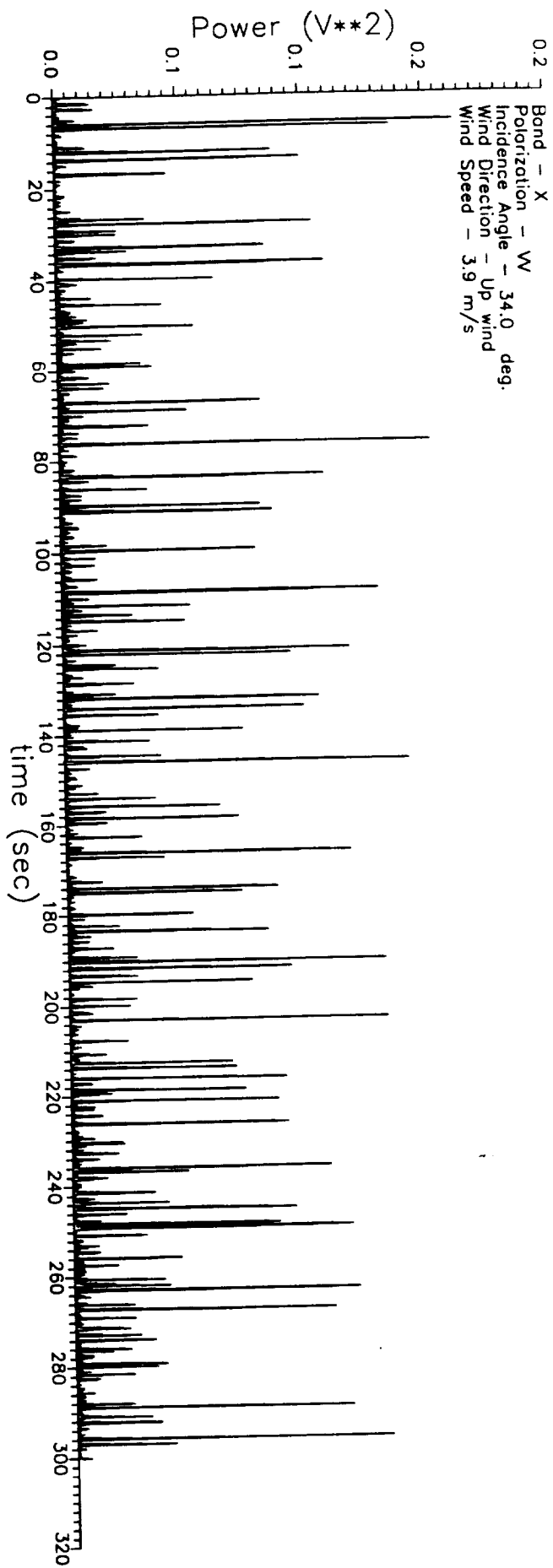
Run 22, 20:11, Aug 3, 1989

Band - X
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.1 m/s

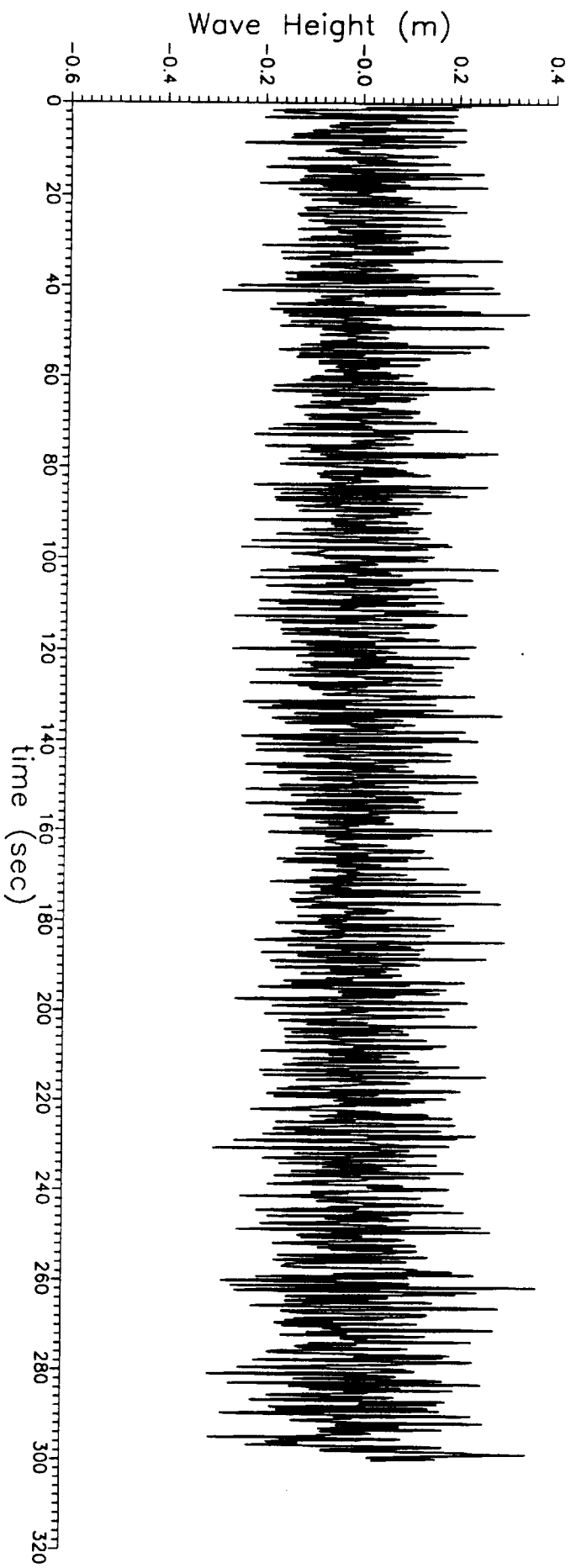
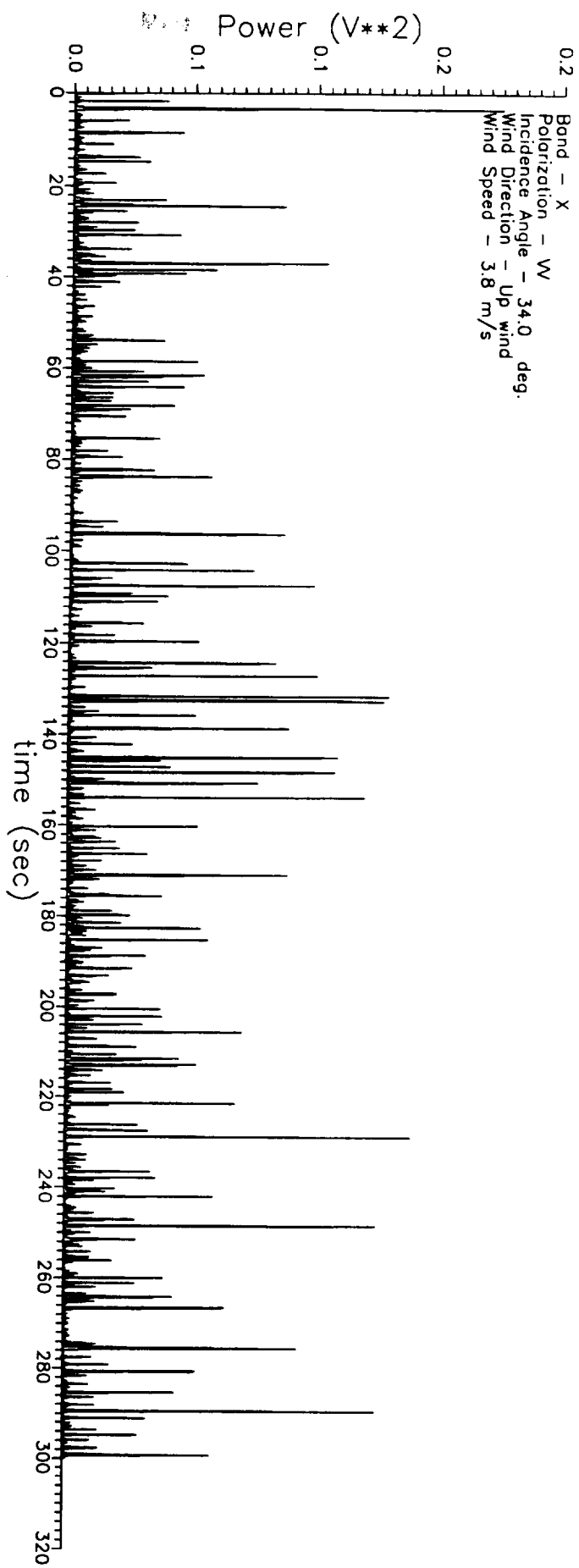


Run 23, 20:16, Aug 5, 1989

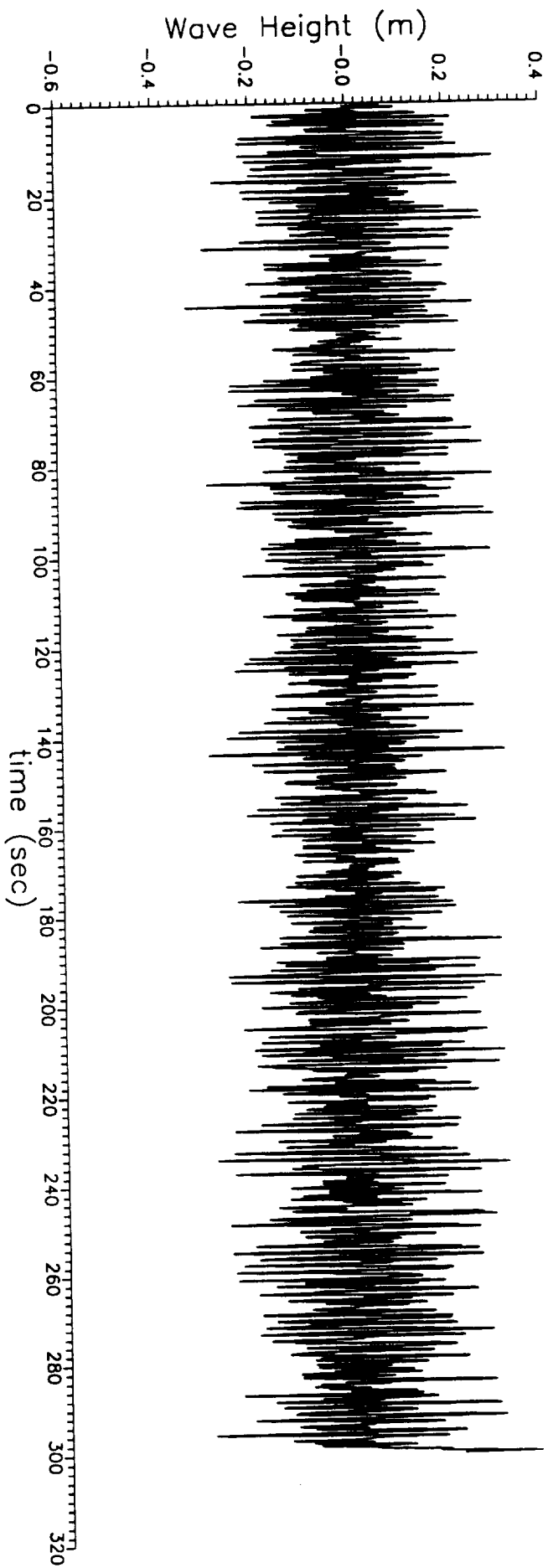
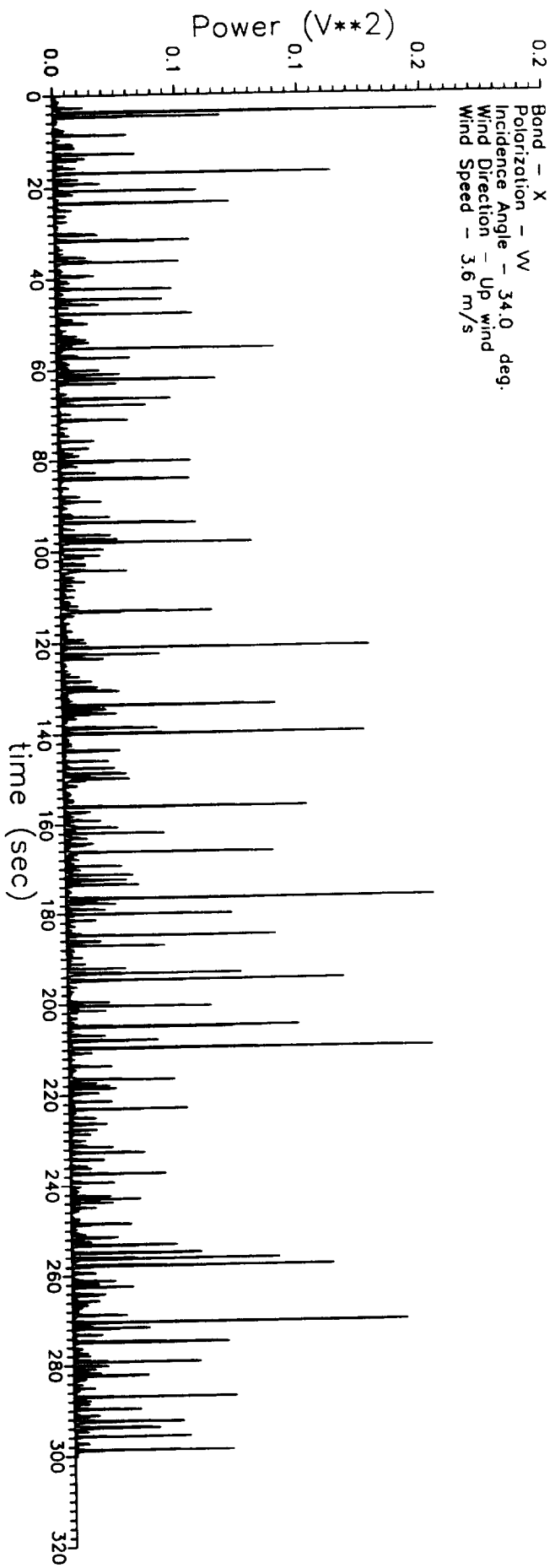
Bond - X
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s



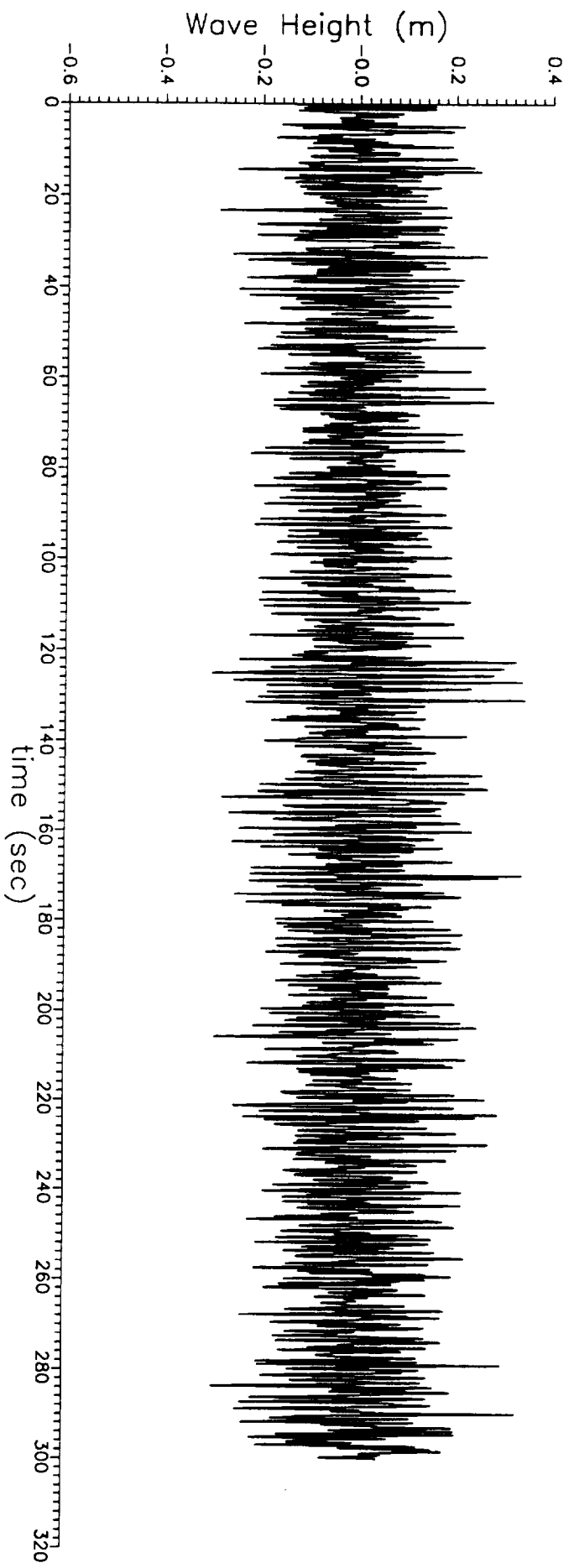
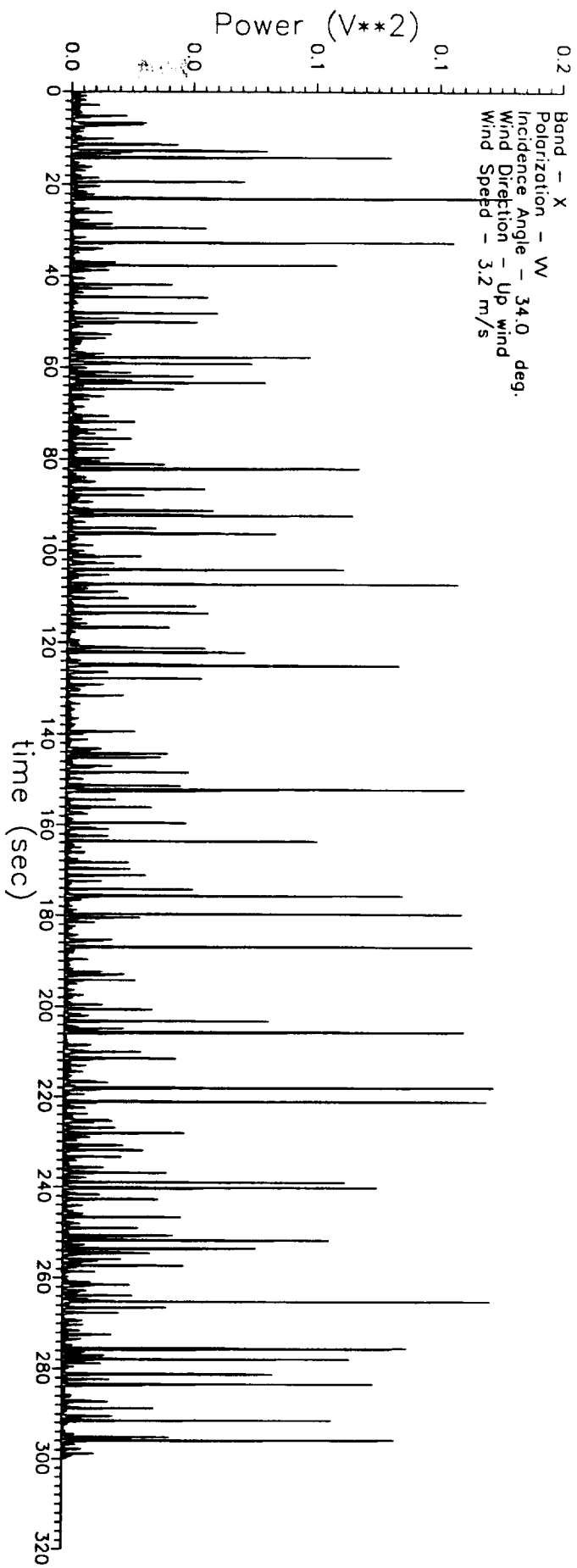
Run 24, 20:22, Aug 3, 1989



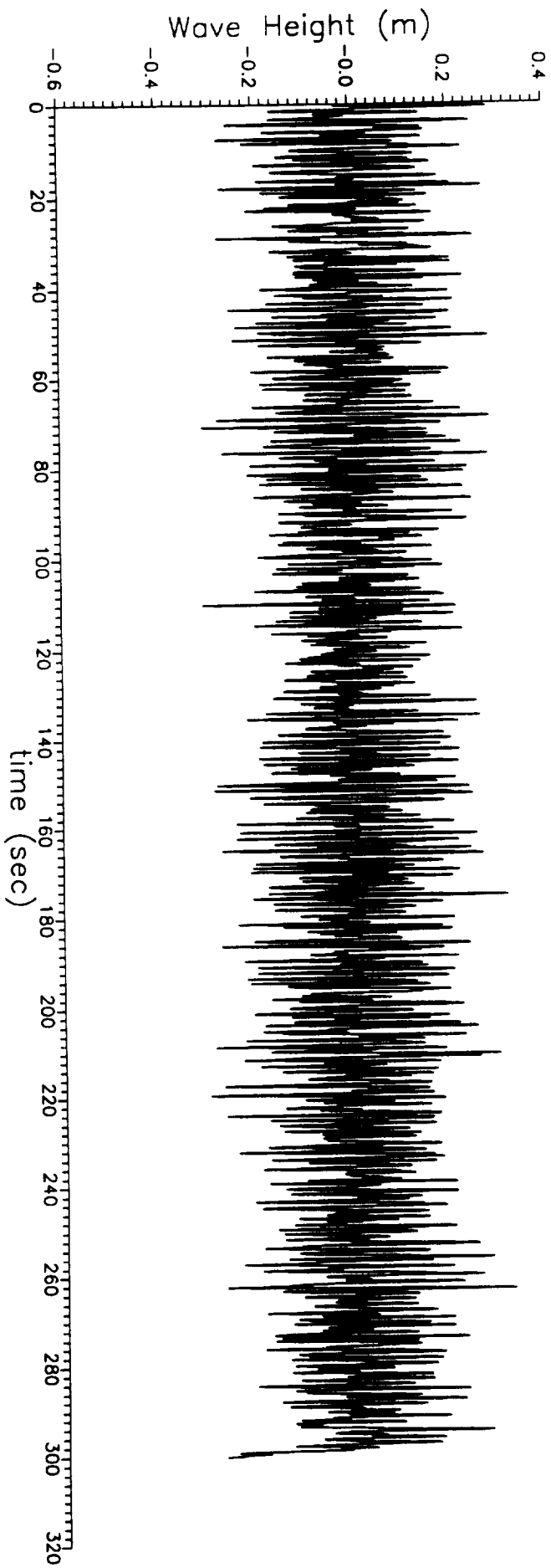
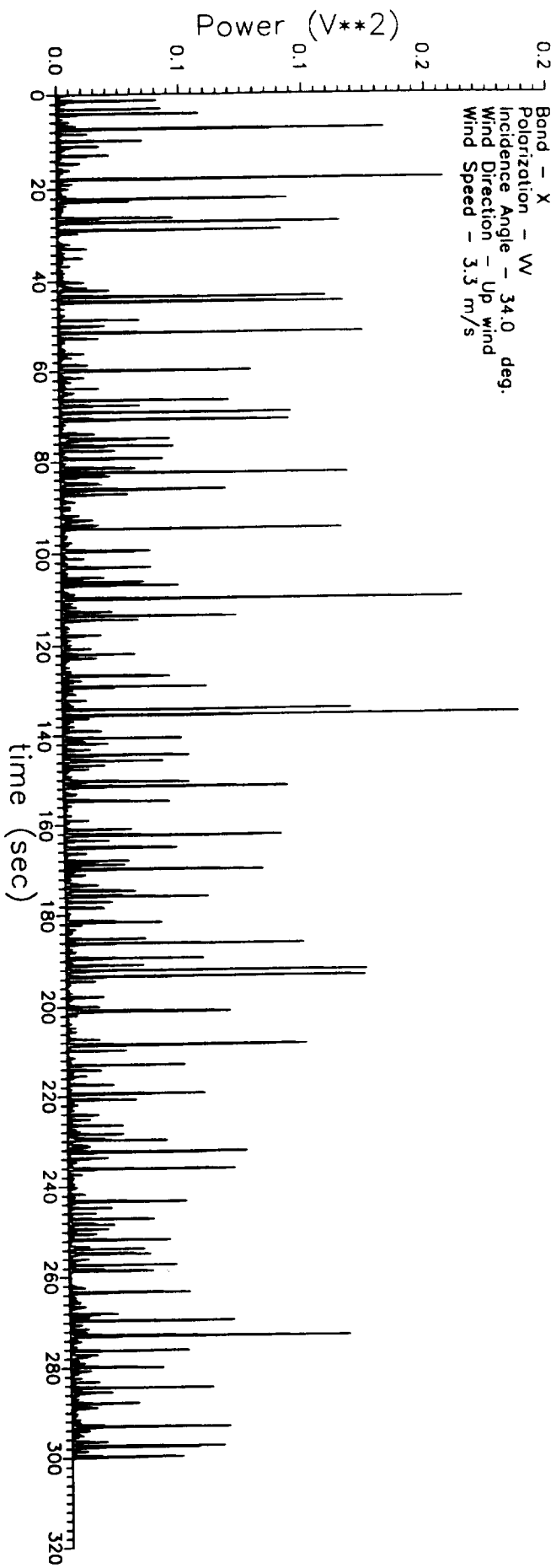
Run 25, 20:28, Aug 3, 1989



Run 26, 20:33, Aug 3, 1989

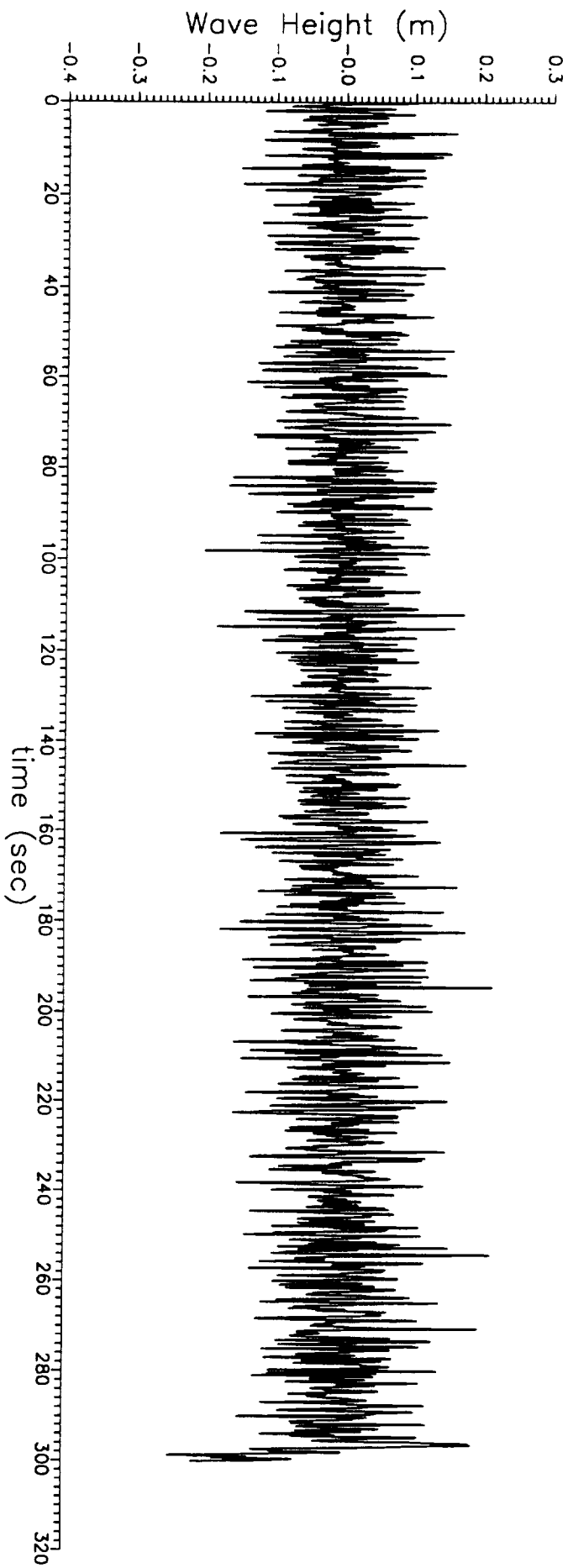
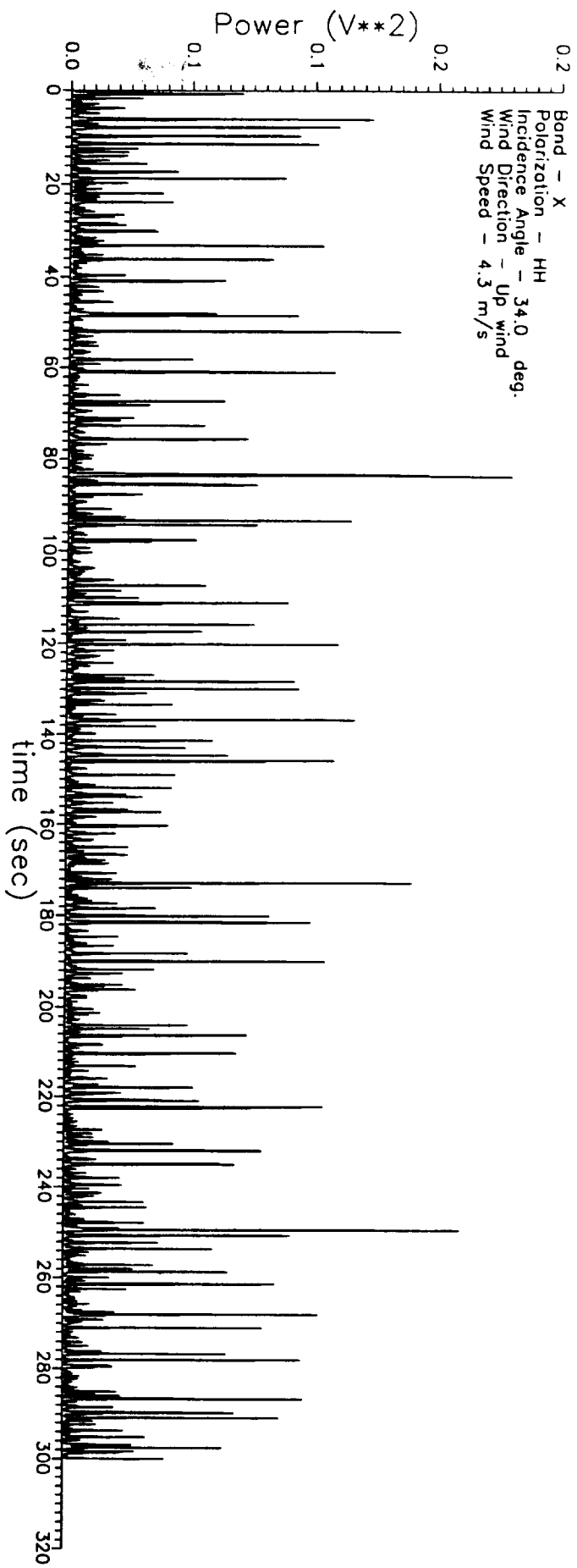


Run 27, 20:39, Aug 3, 1989

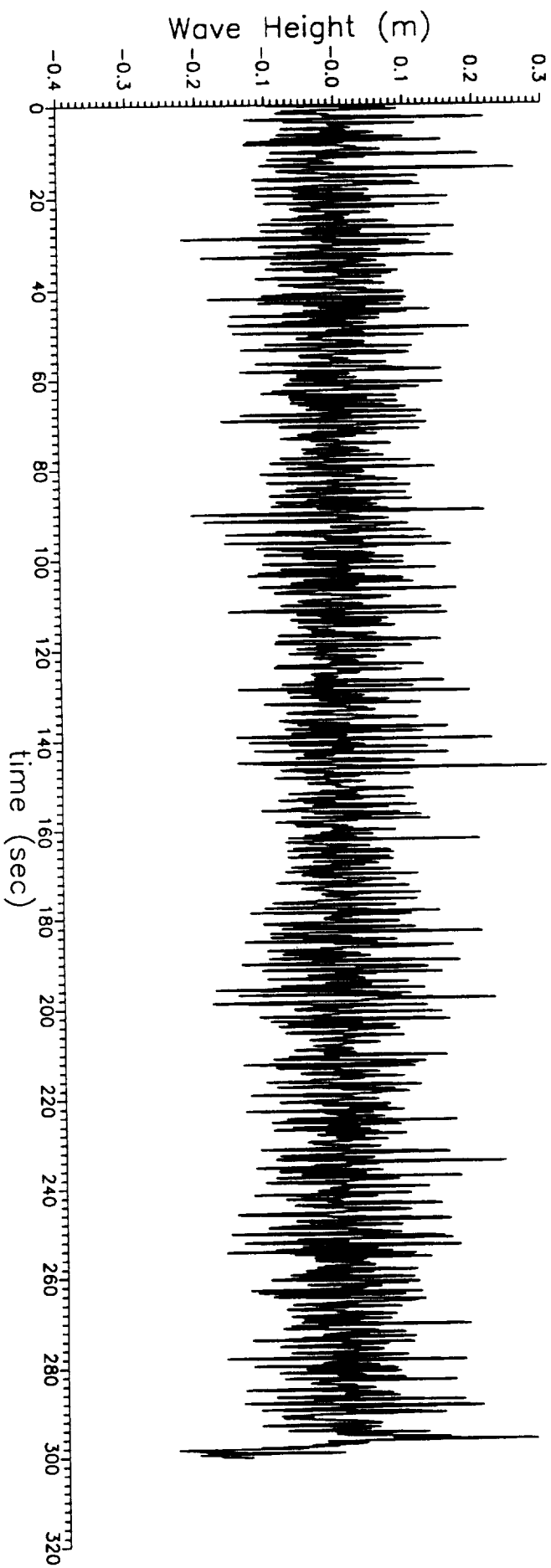
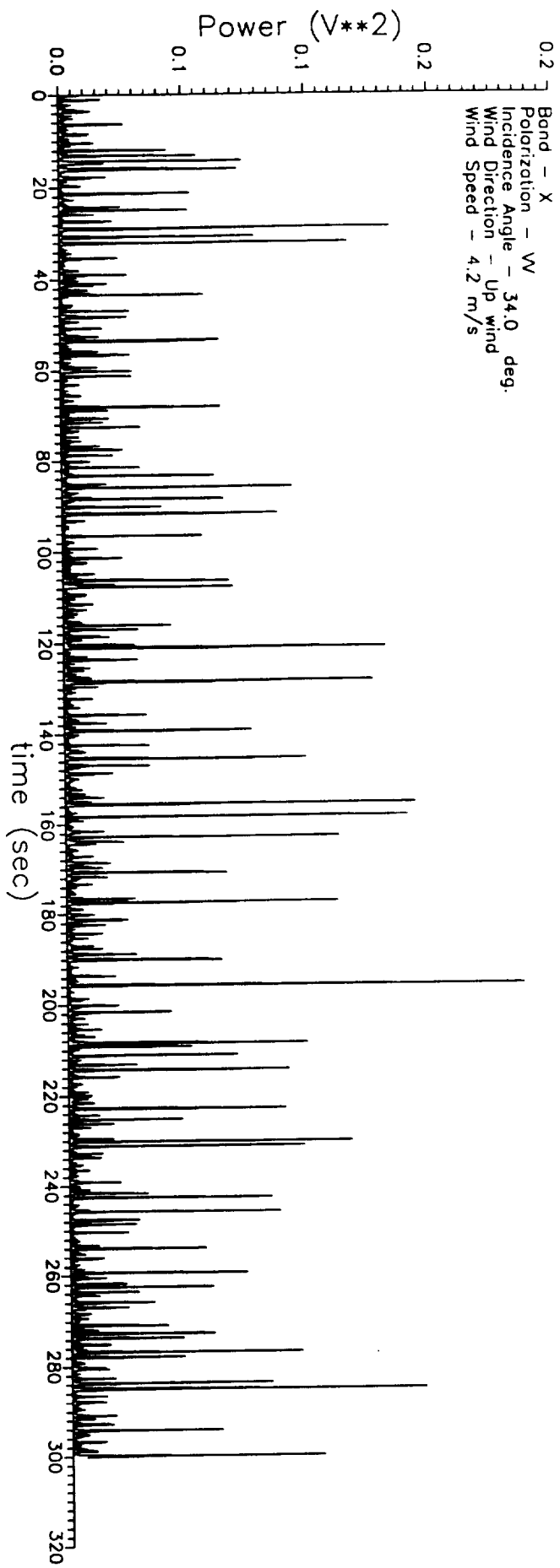


Run 25, 18:16, Aug 4, 1989

Bond - X
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Up wind
Wind Speed - 4.3 m/s

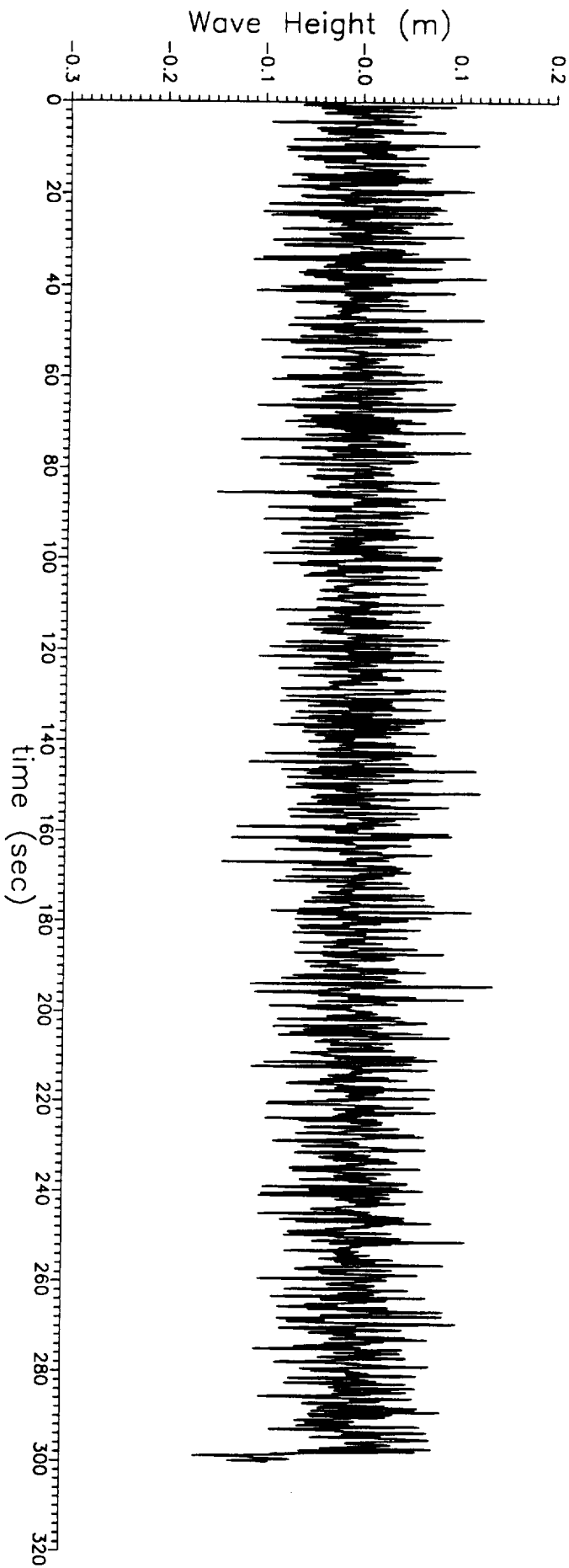
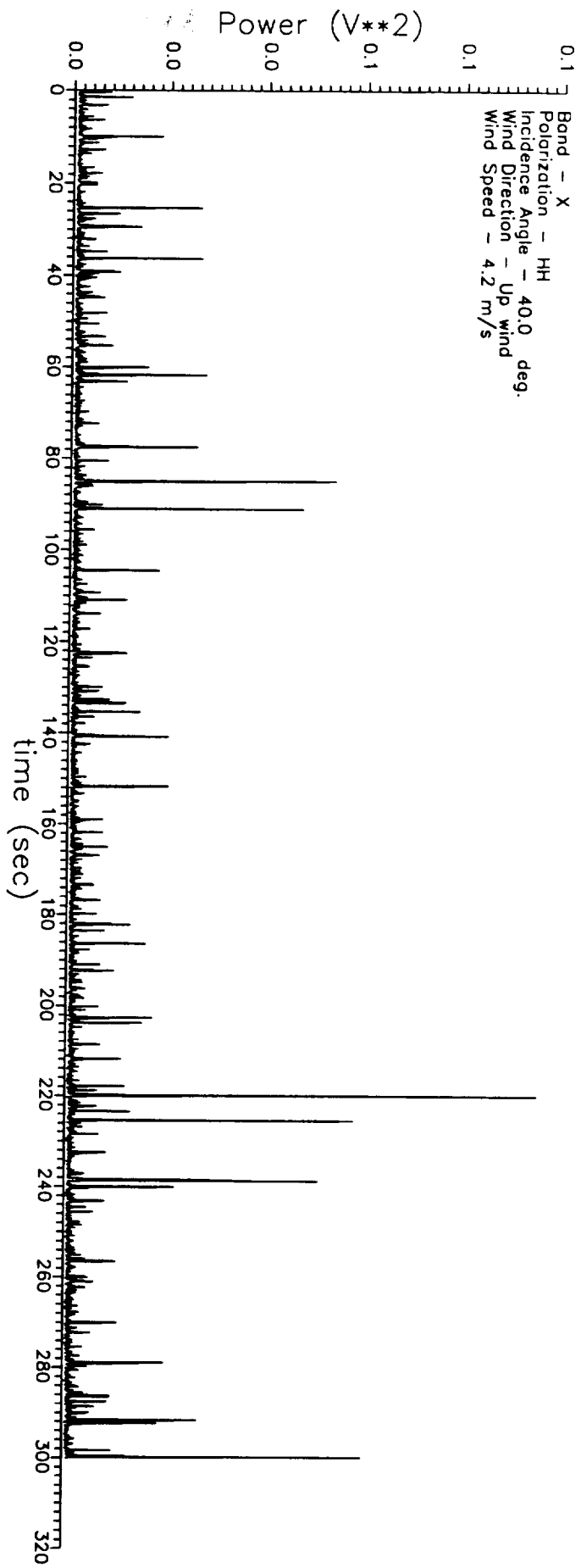


Run 27, 18:29, Aug 4, 1989



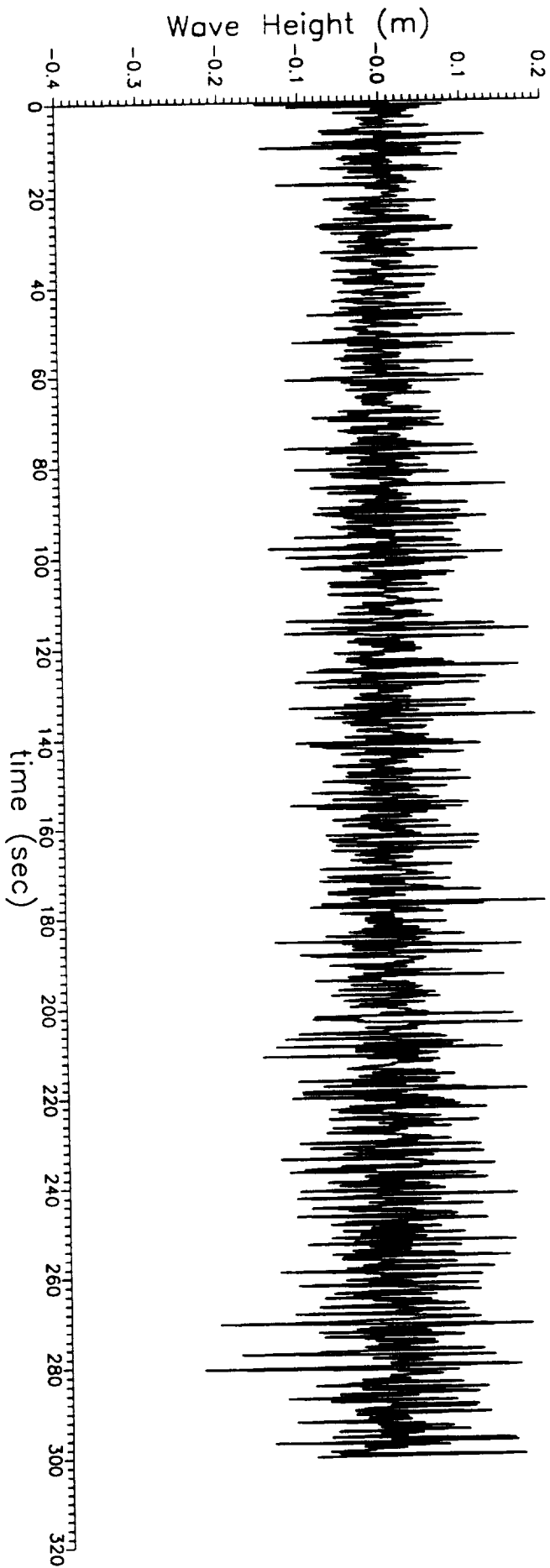
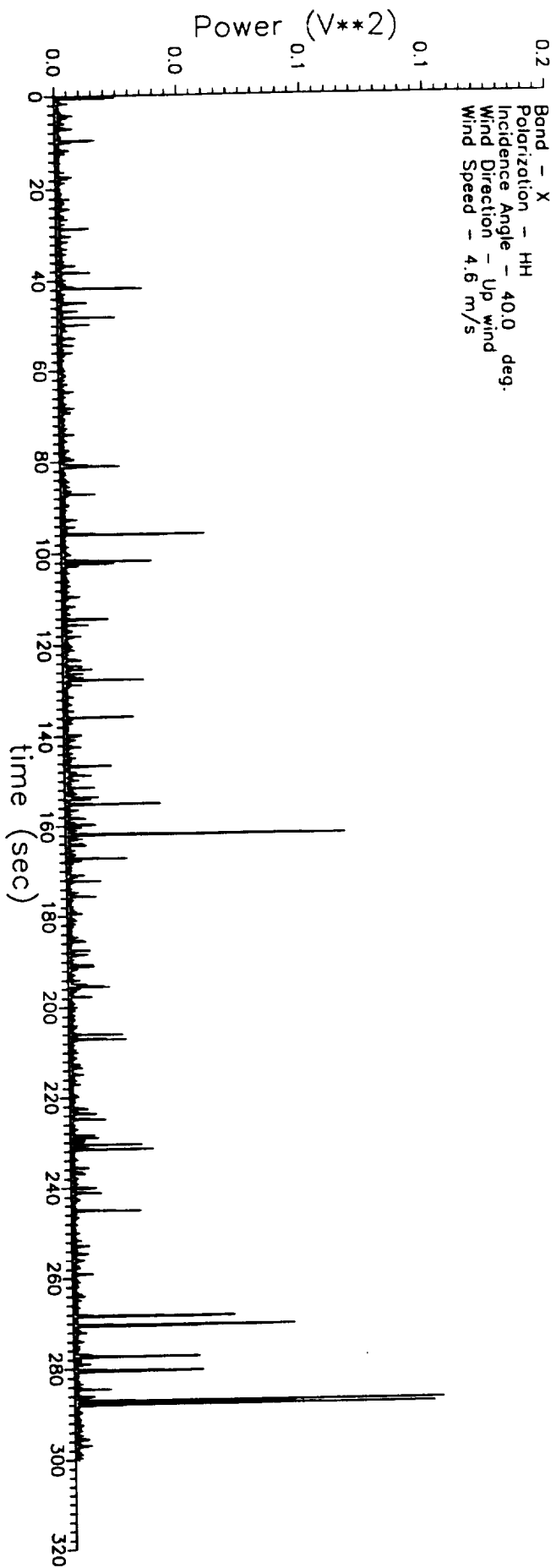
Run 39, 20:16, Aug 4, 1989

Bond - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.2 m/s



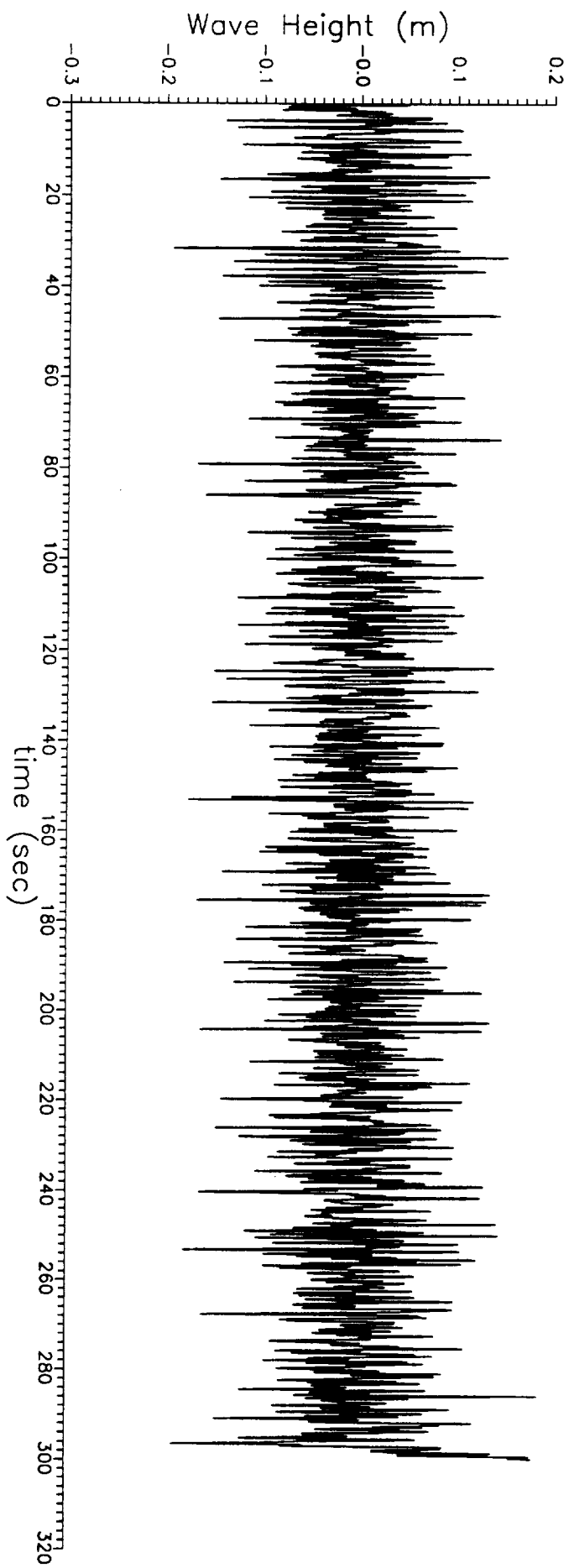
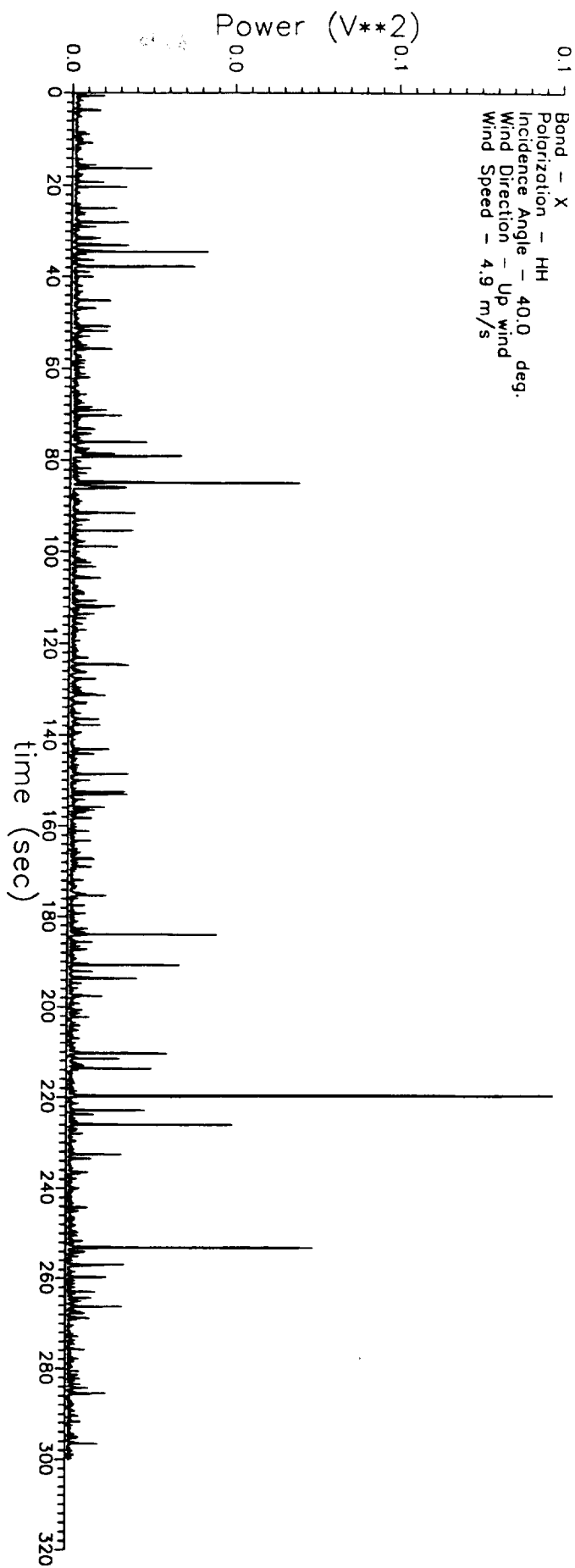
Run 40, 20:22, Aug 4, 1989

Band - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.6 m/s

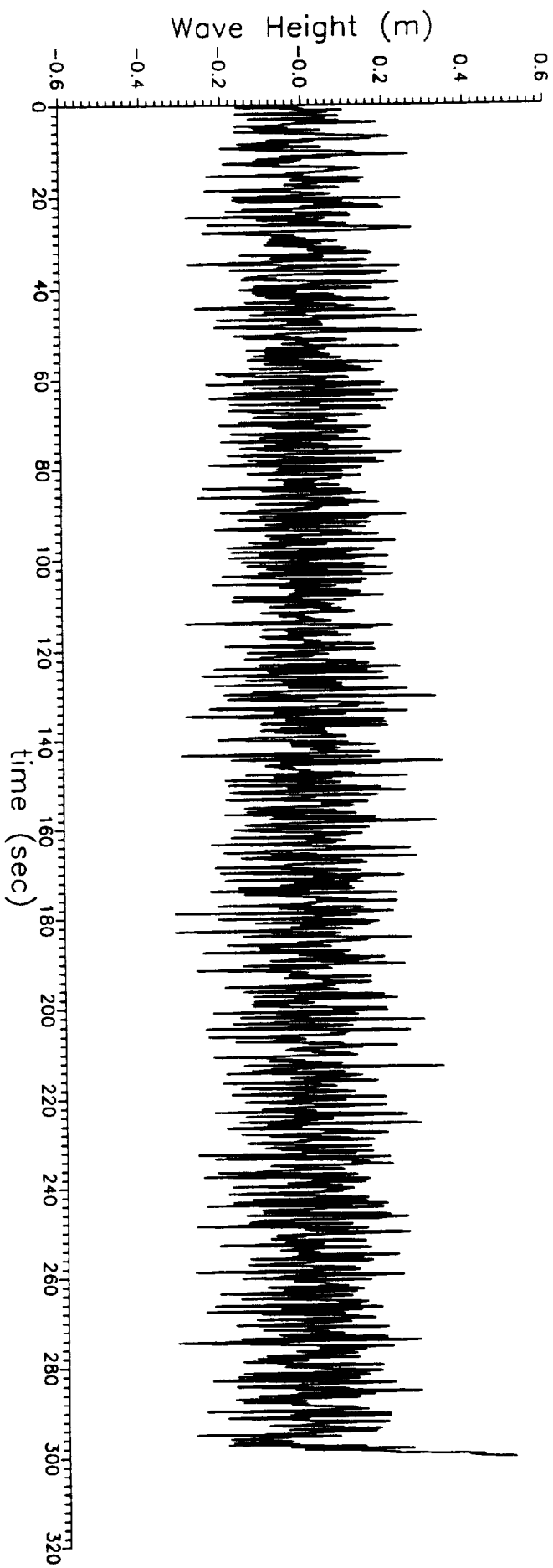
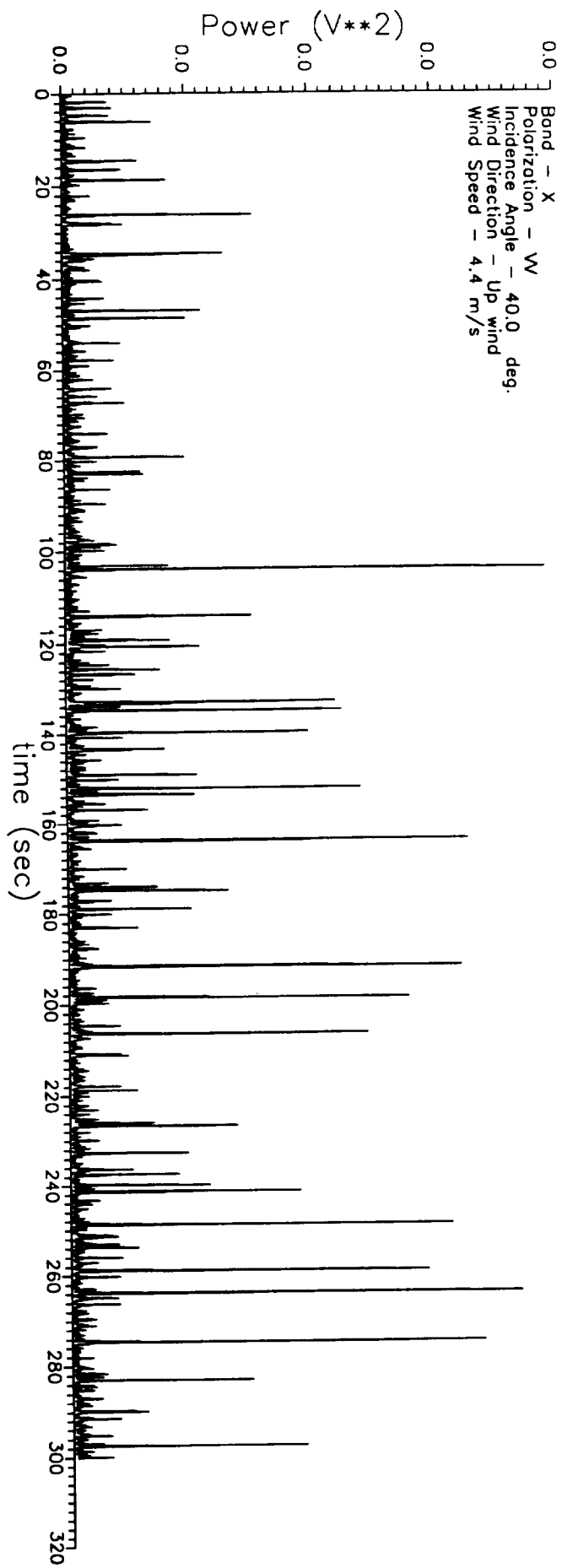


Run 41, 20:28, Aug 4, 1989

Bond - X
Polarization - HH
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.9 m/s

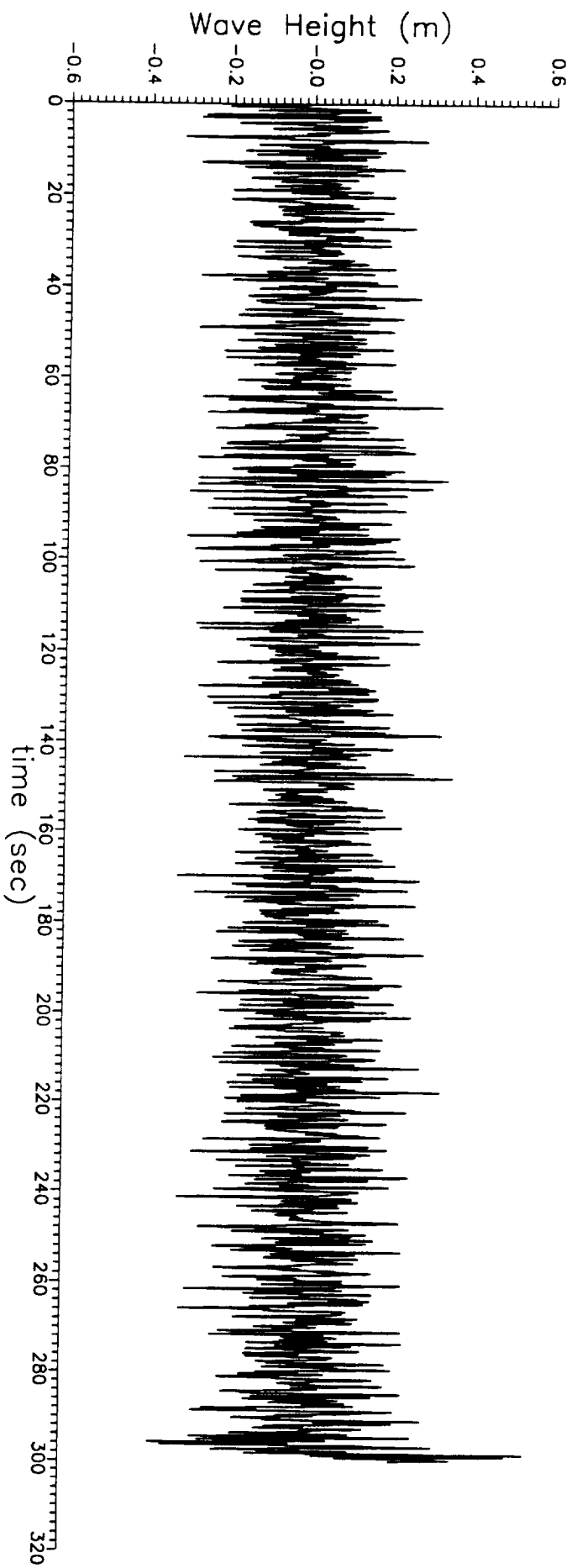
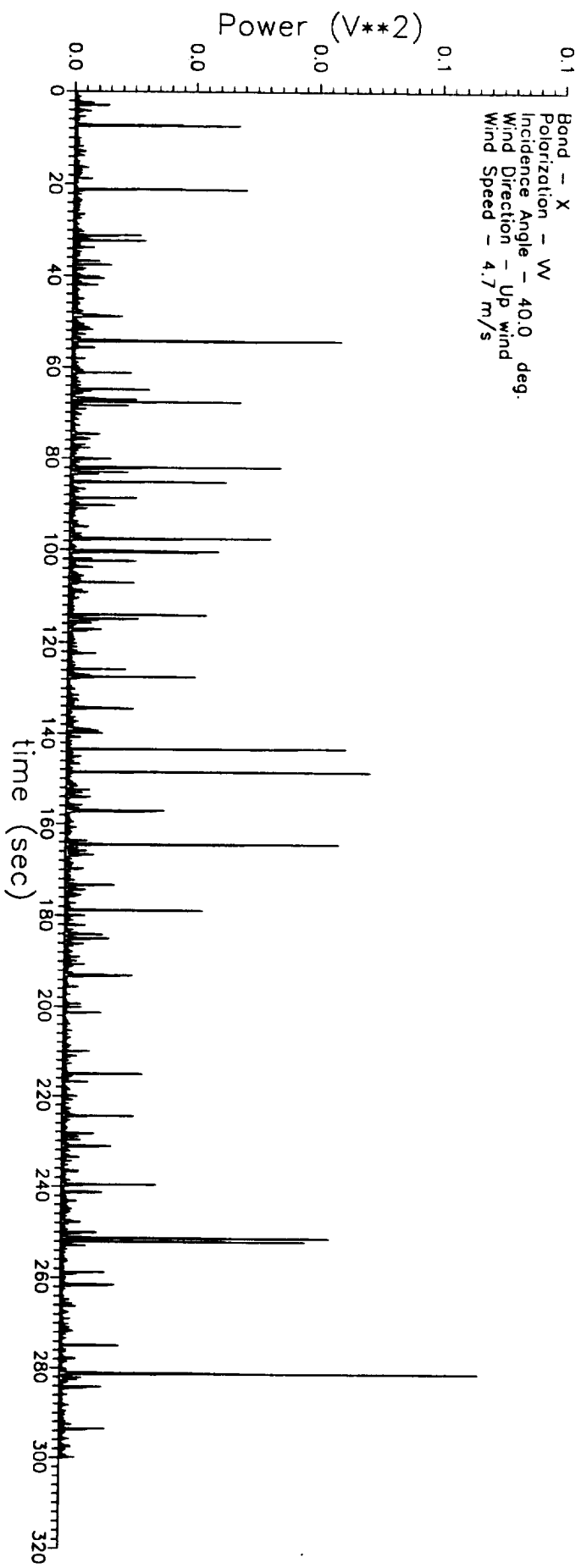


Run 42, 20:40, Aug 4, 1989



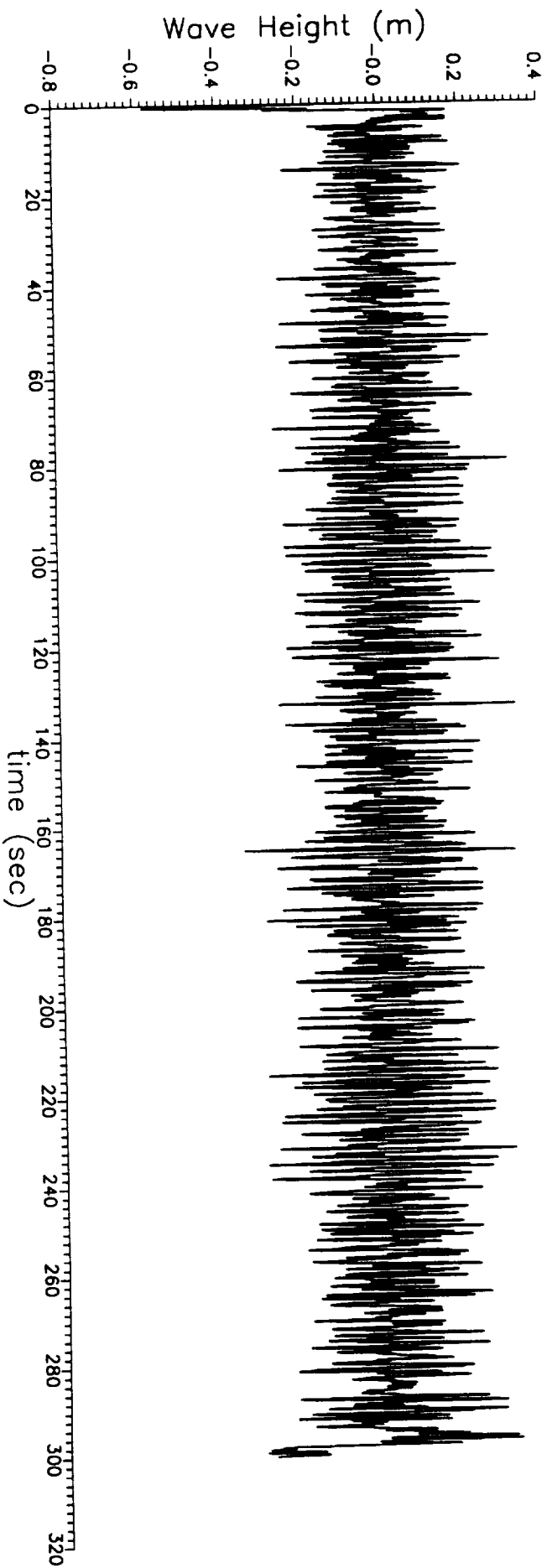
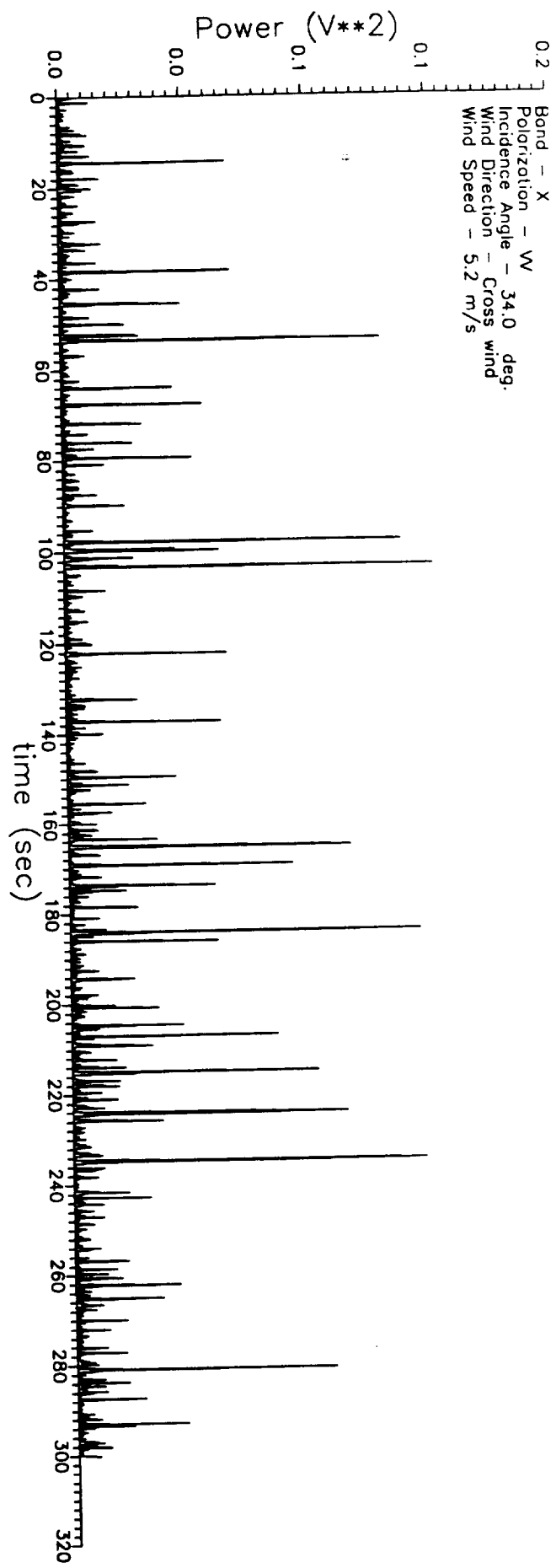
Run 43, 20:46, Aug 4, 1989

Bond - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.7 m/s

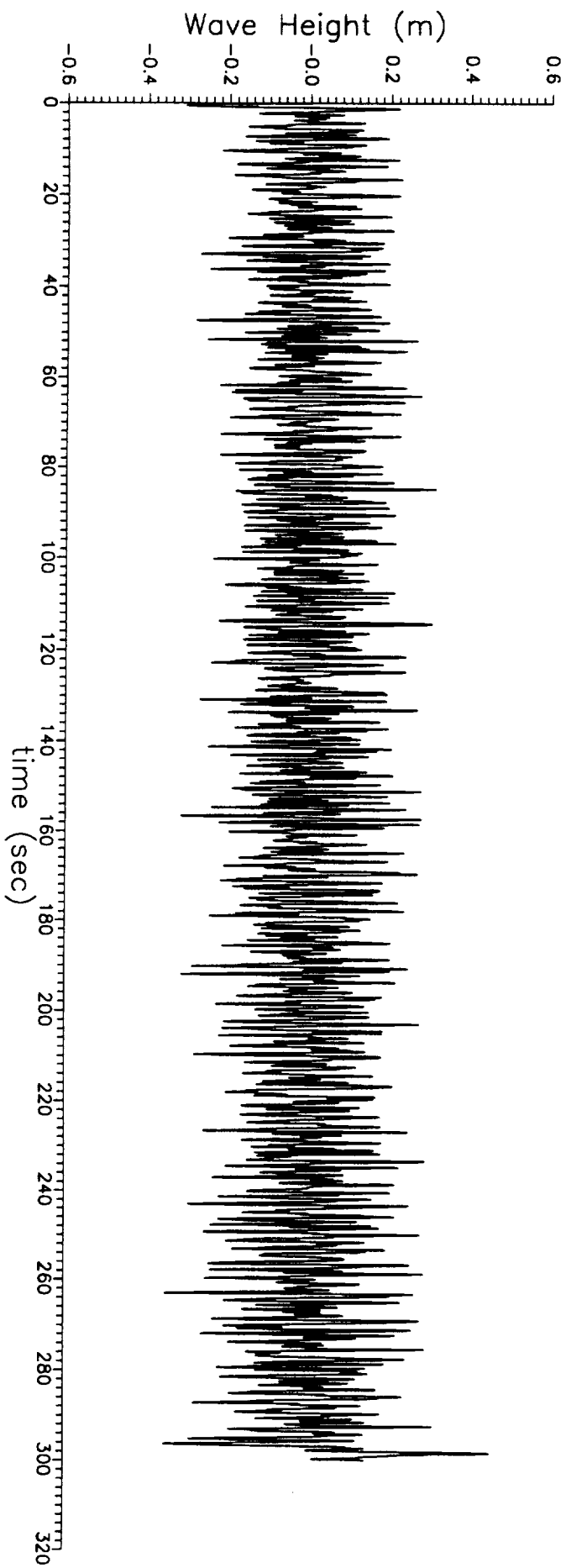
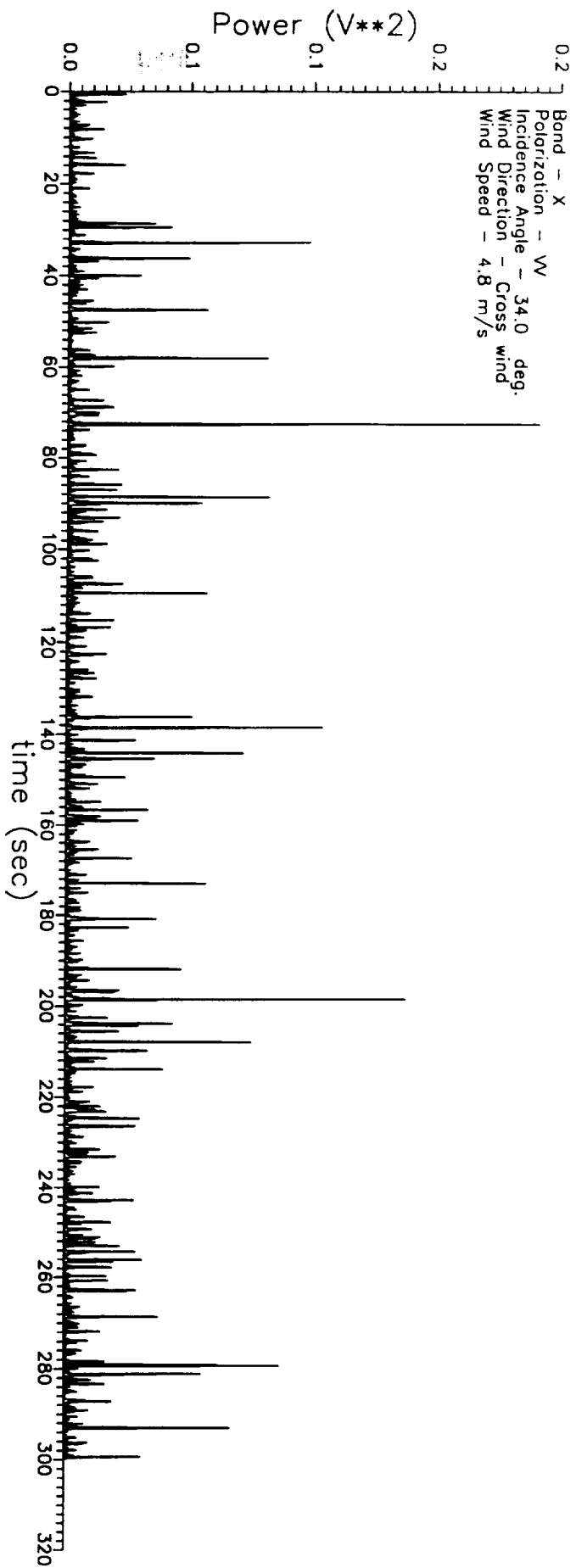


Run 15, 17:55, Aug 6, 1989

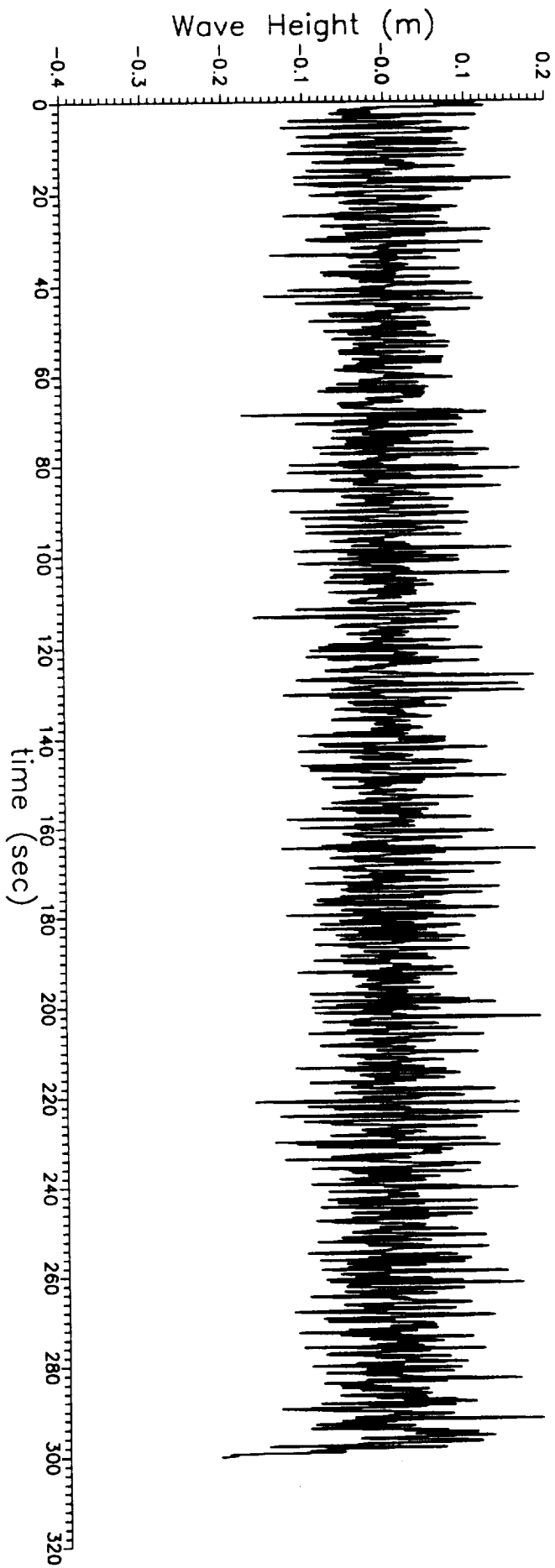
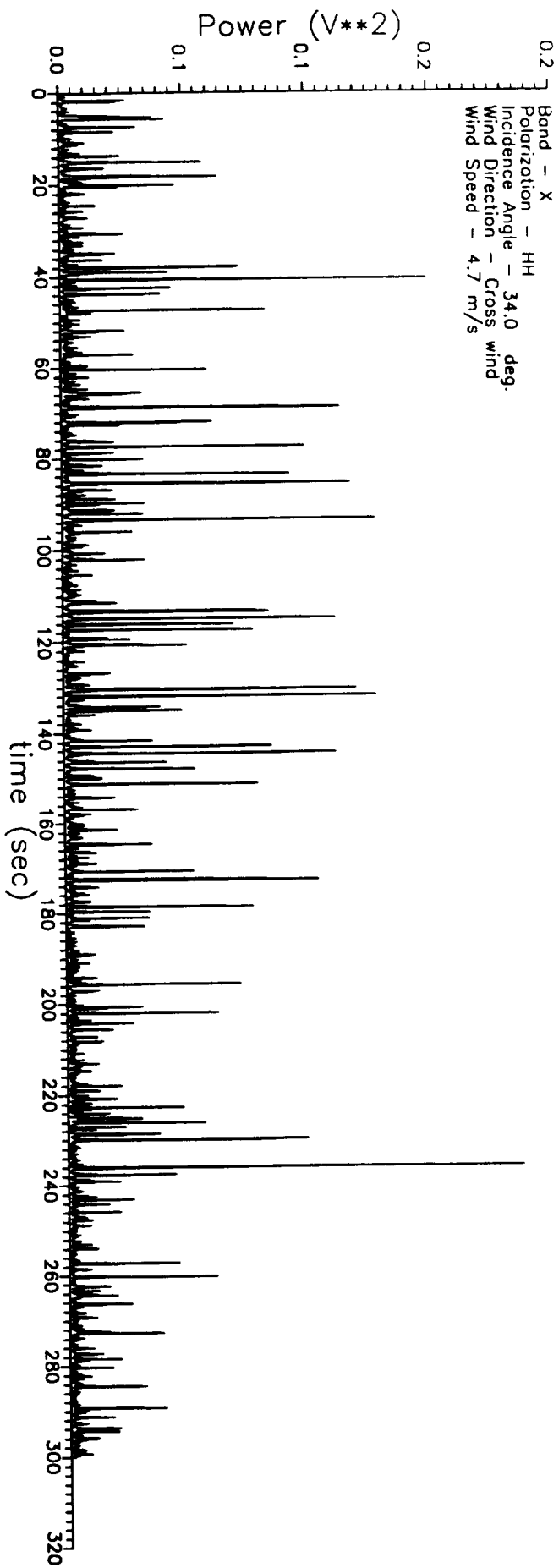
Band - X
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.2 m/s



Run 16, 18:03, Aug 6, 1989

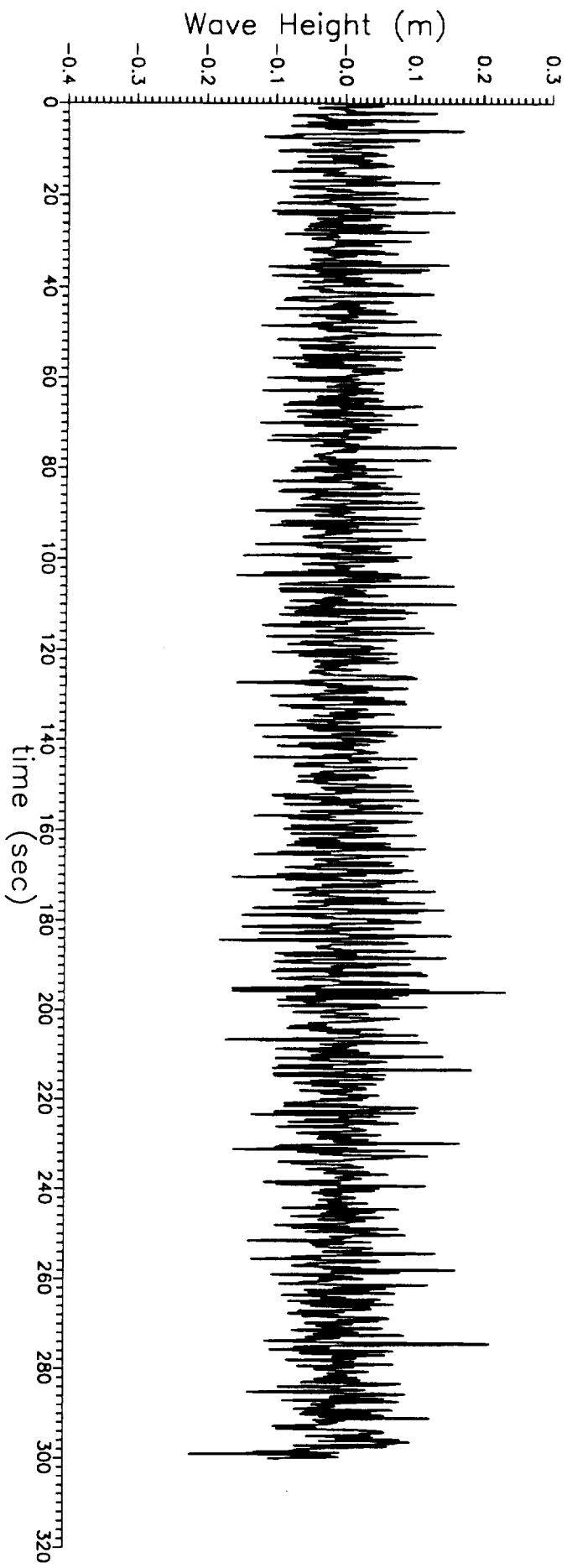
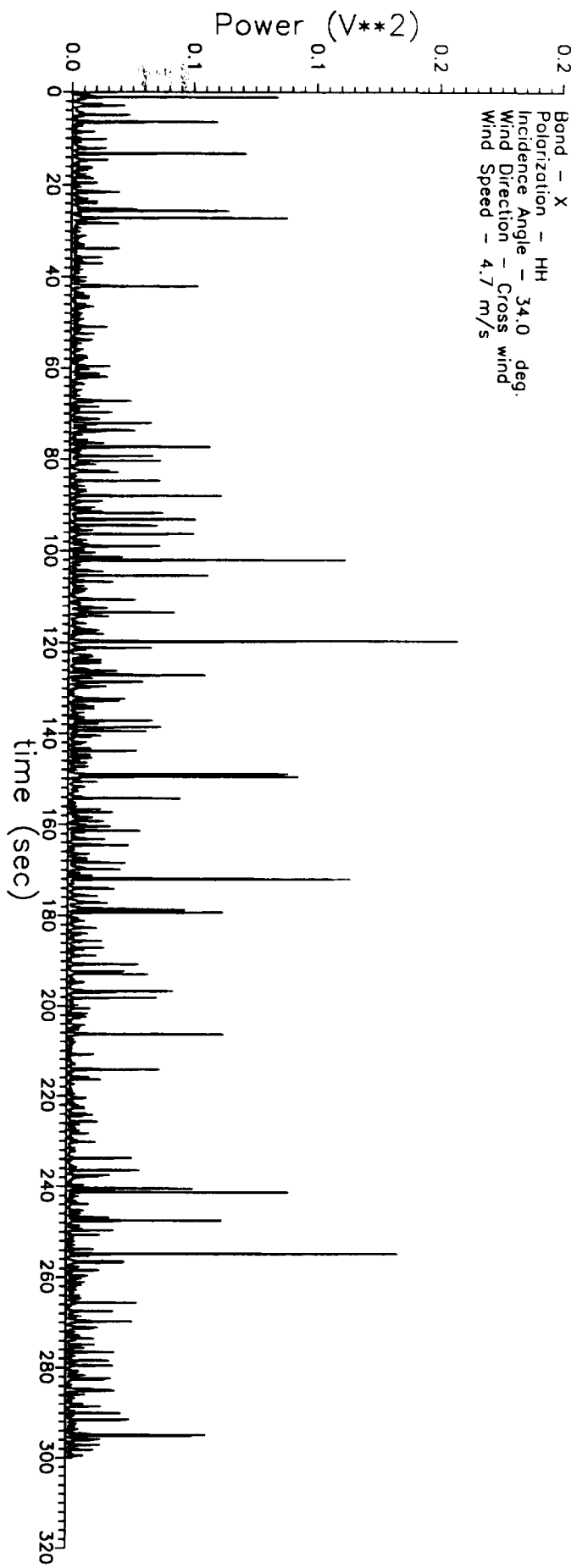


Run 17, 18:10, Aug 6, 1989

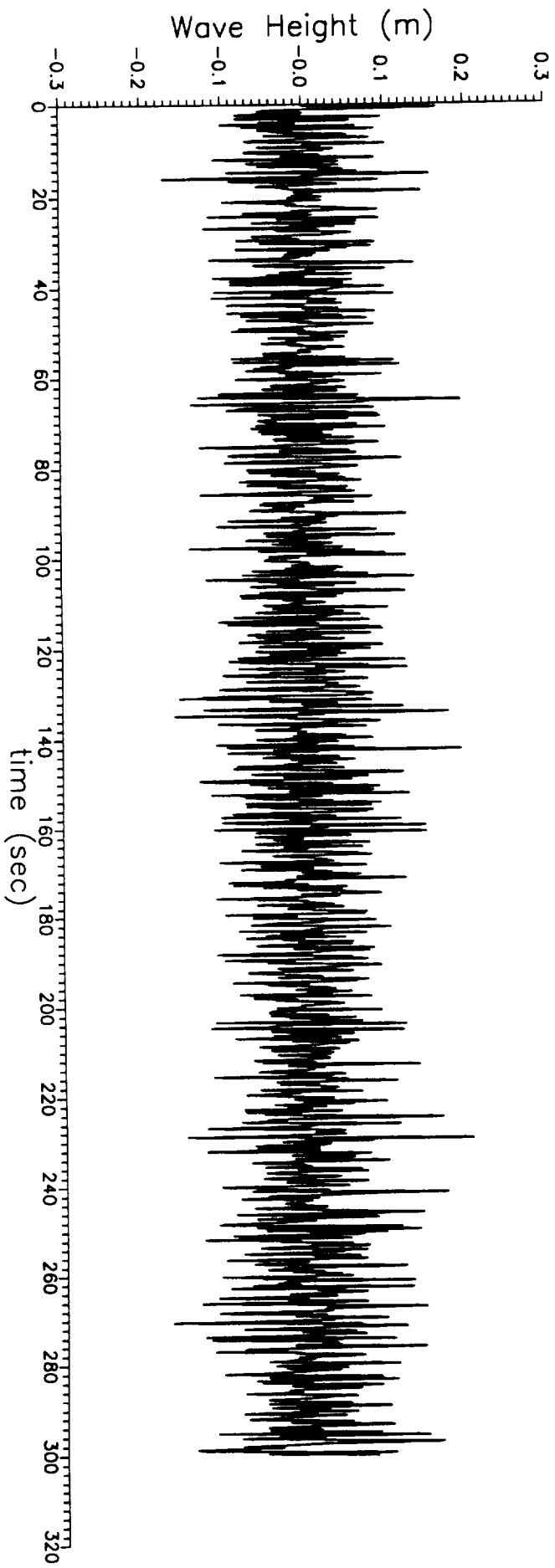
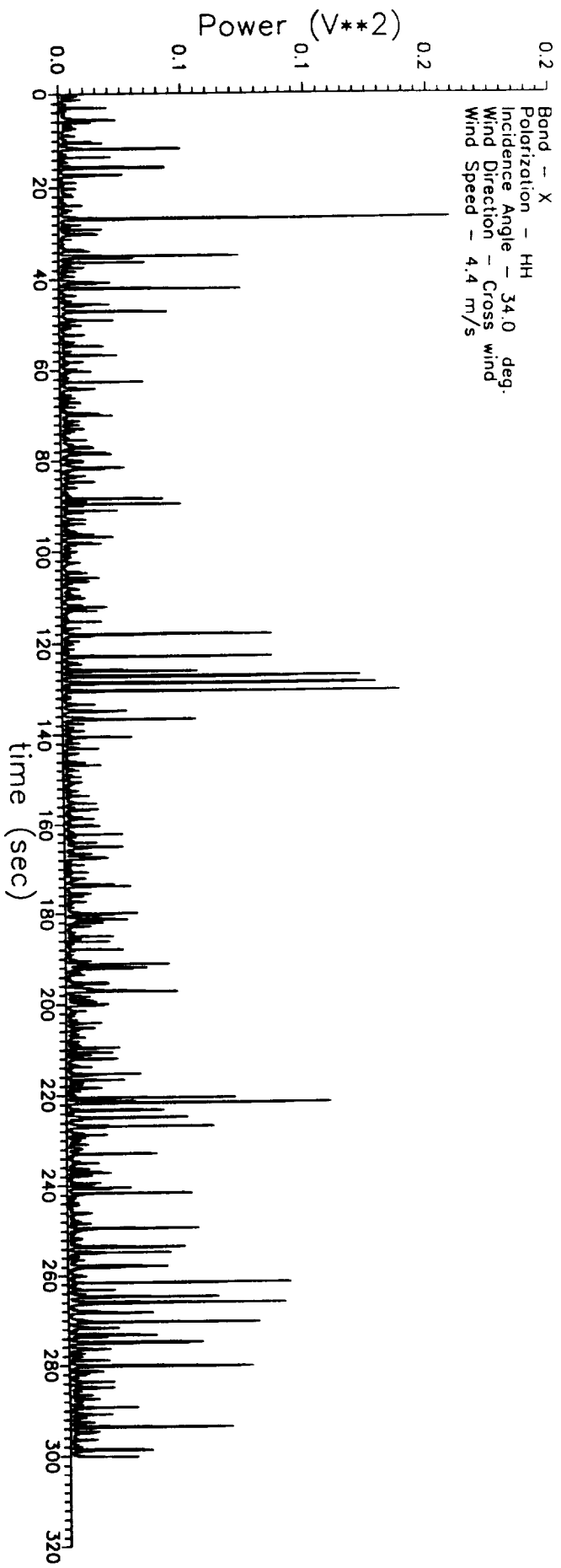


Run 18, 18:16, Aug 6, 1989

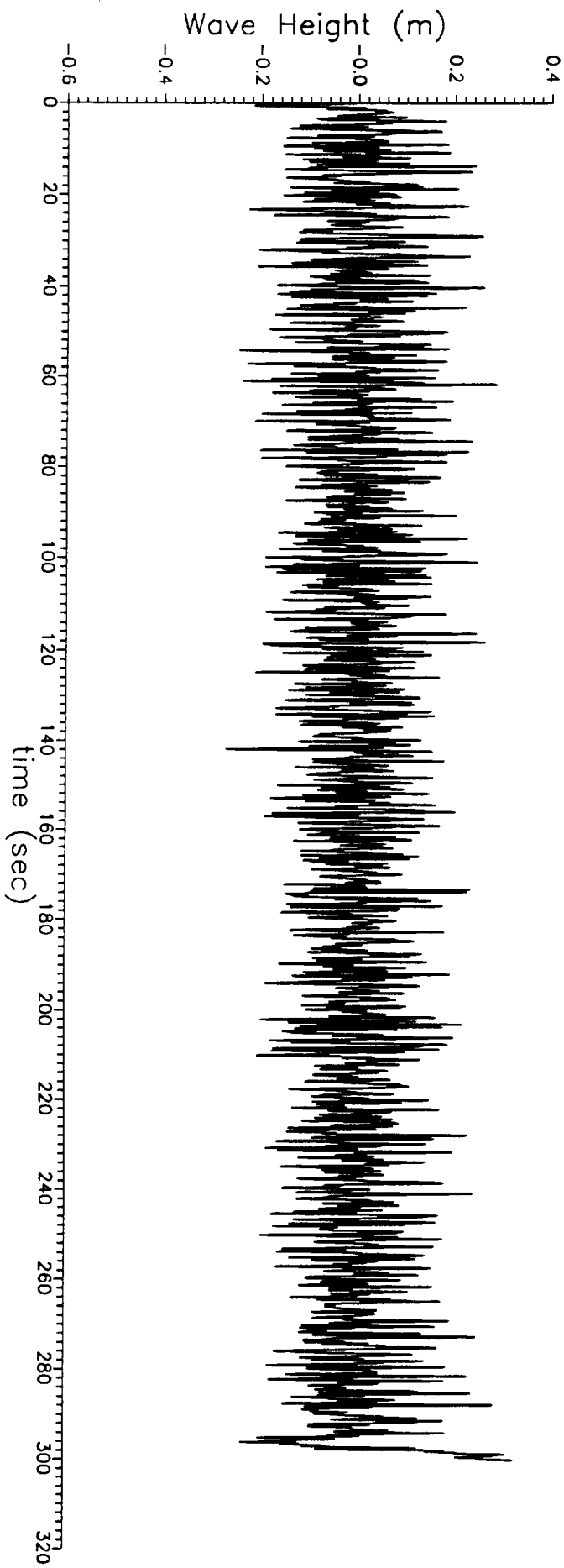
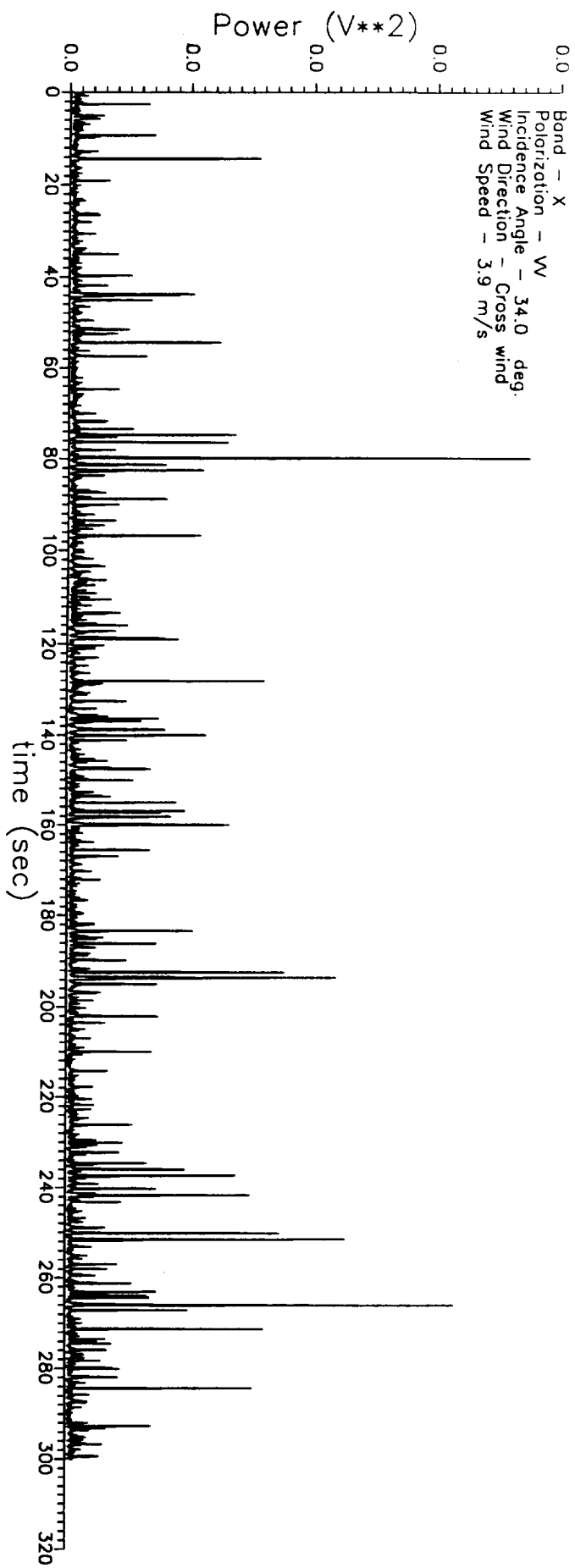
Bond - X
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 4.7 m/s



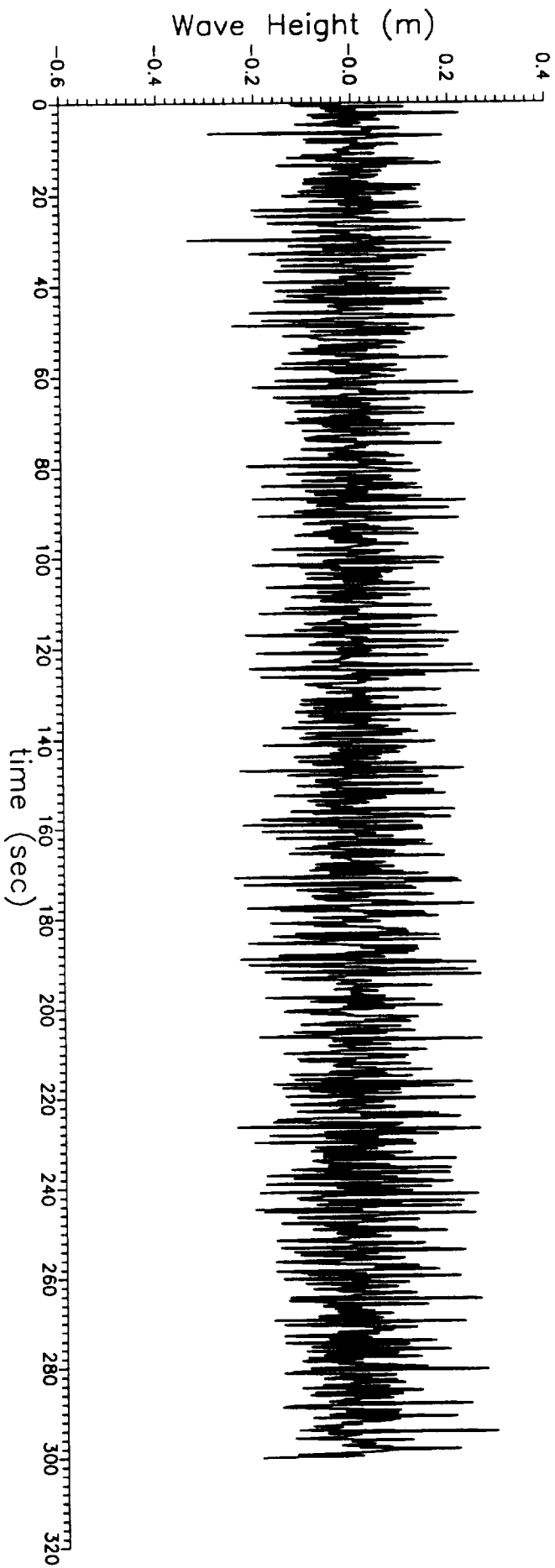
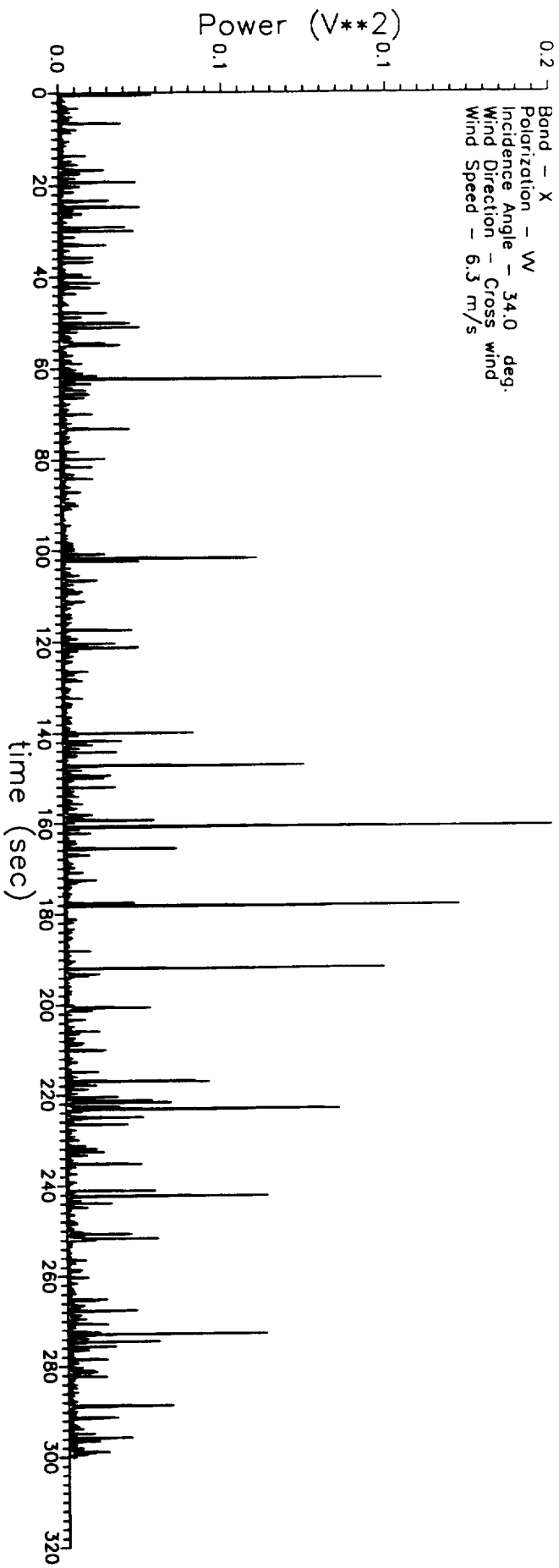
Run 19, 18:21, Aug 6, 1989



Run 5, 15:15, Aug 7, 1989

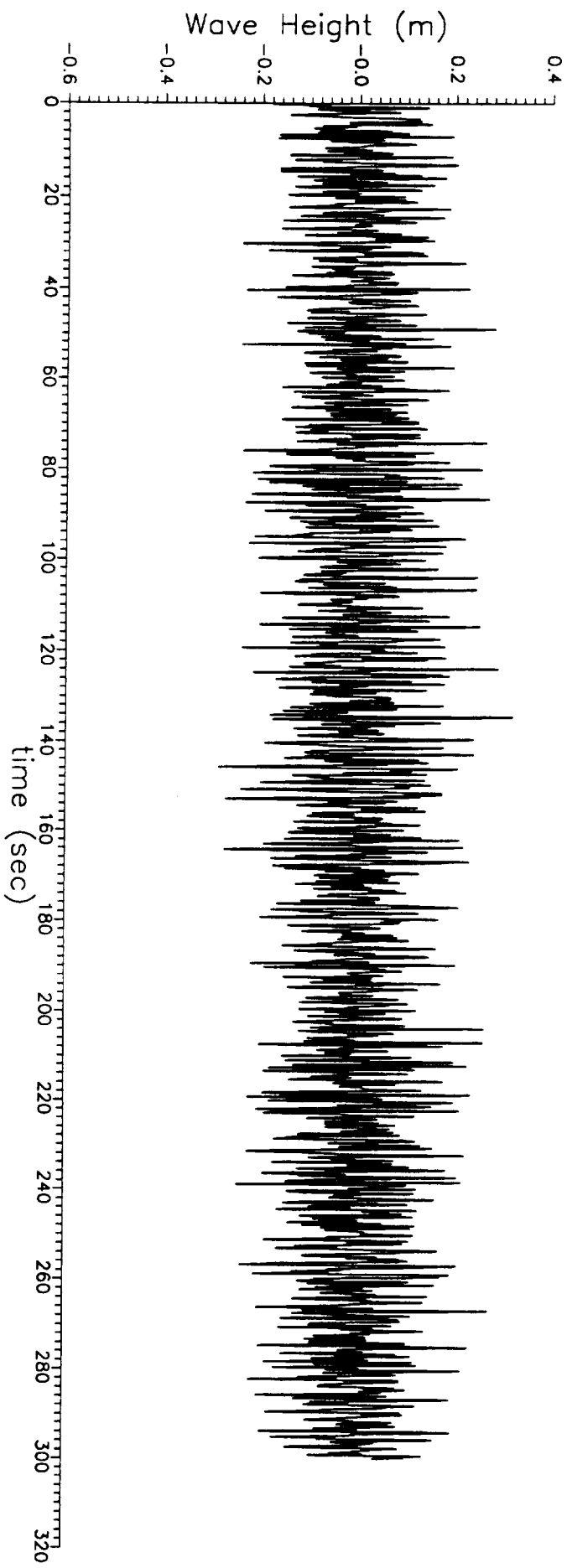
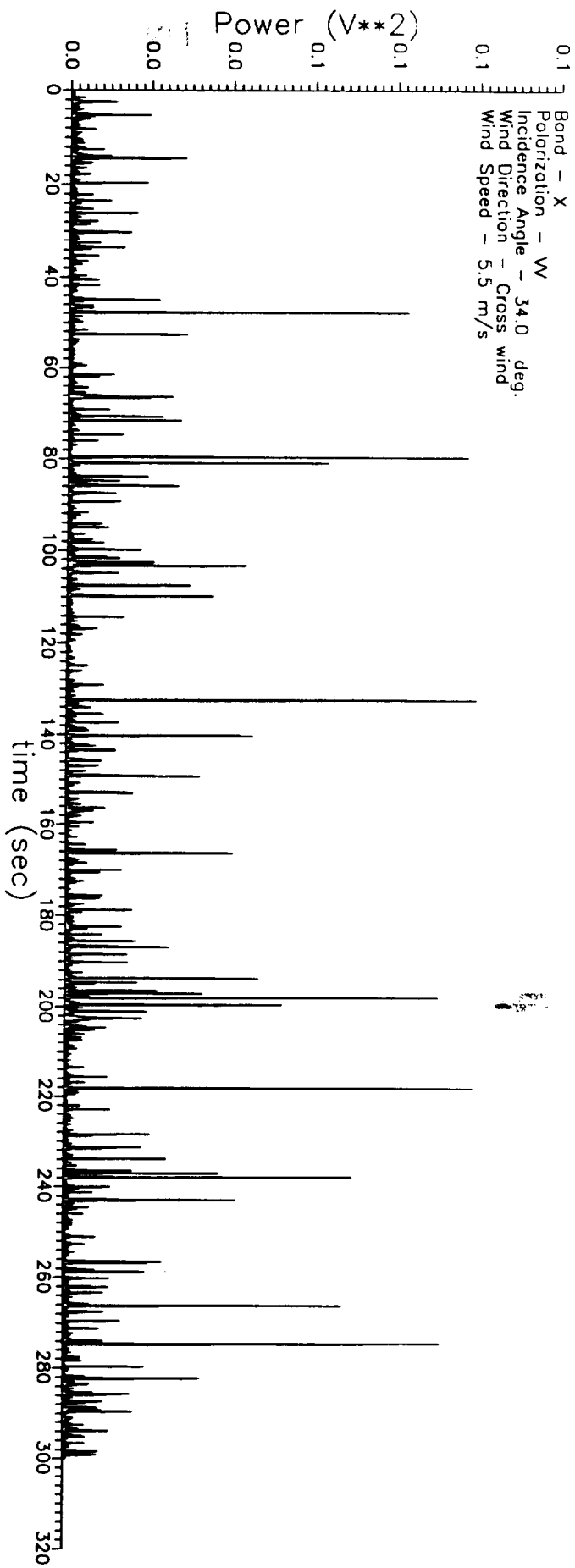


Run 8, 17:40, Aug 7, 1989



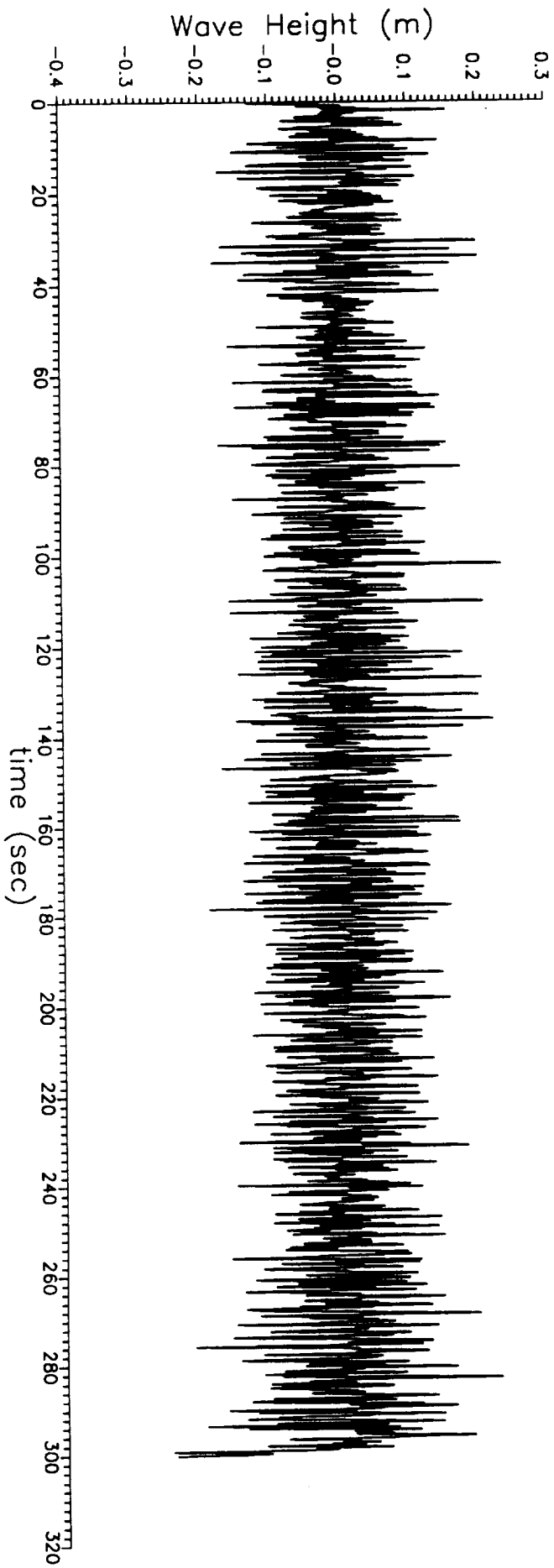
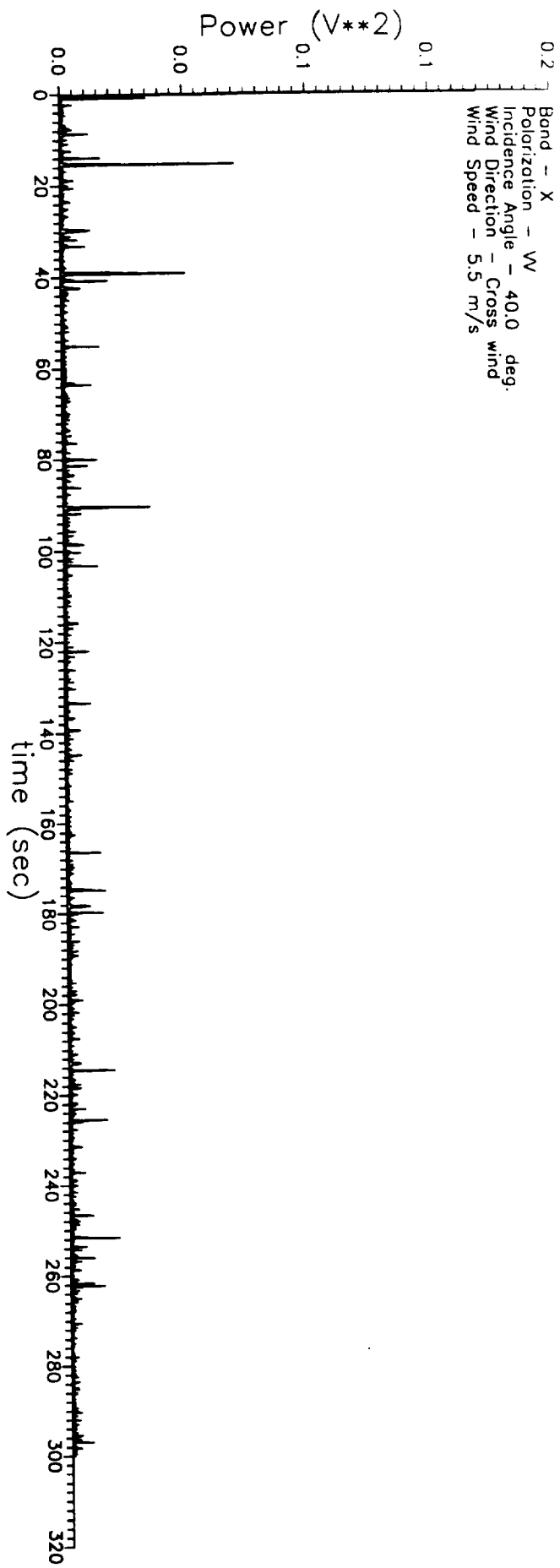
Run 9, 17:45, Aug 7, 1989

Band - X
Polarization - W
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.5 m/s



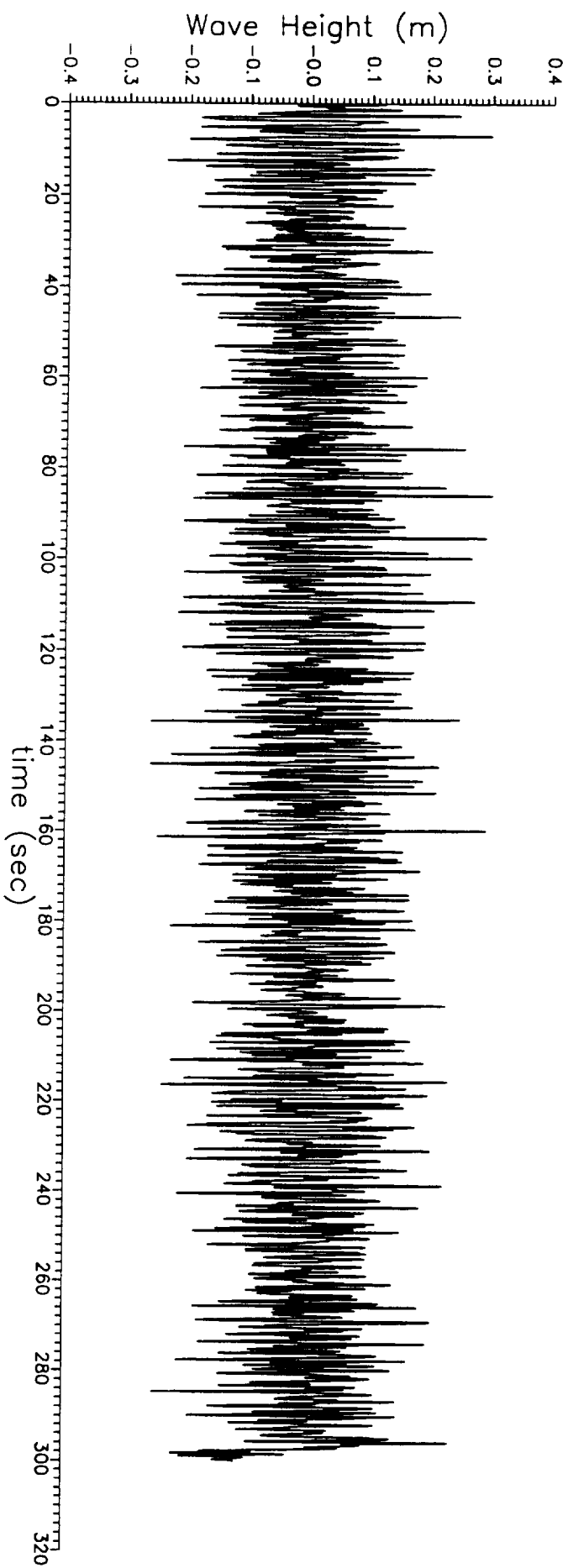
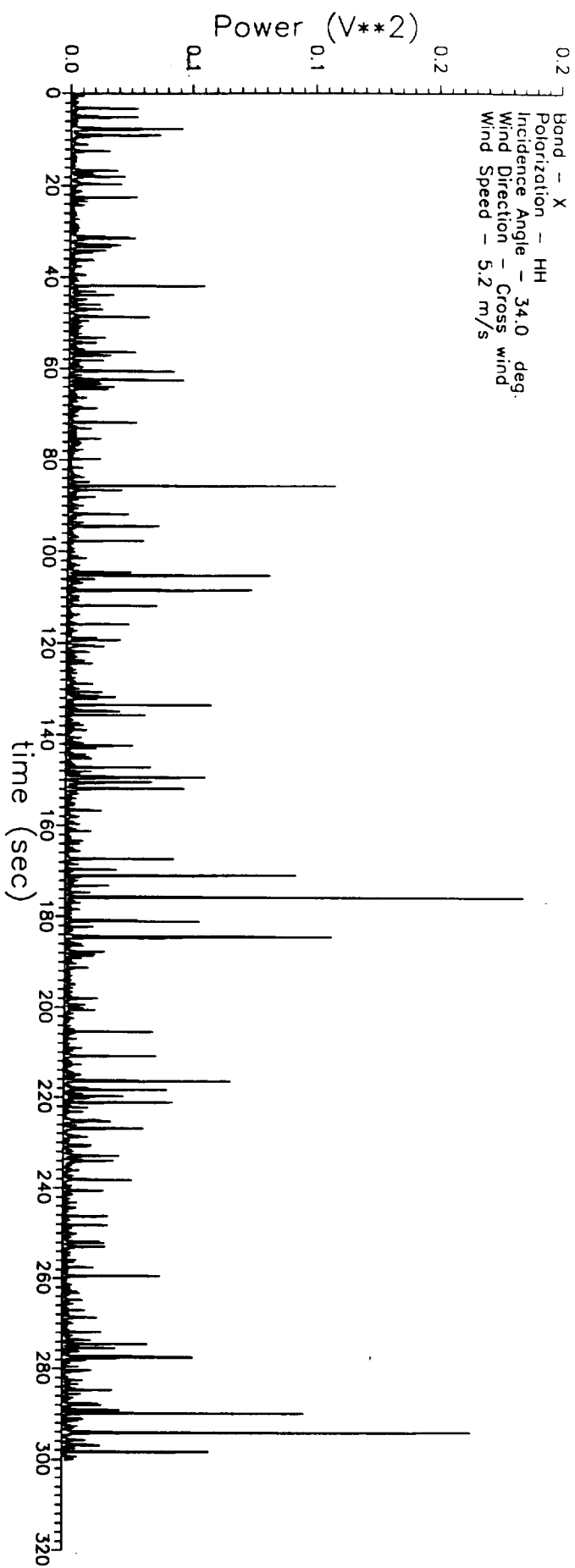
Run 10, 17:52, Aug 7, 1989

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.5 m/s

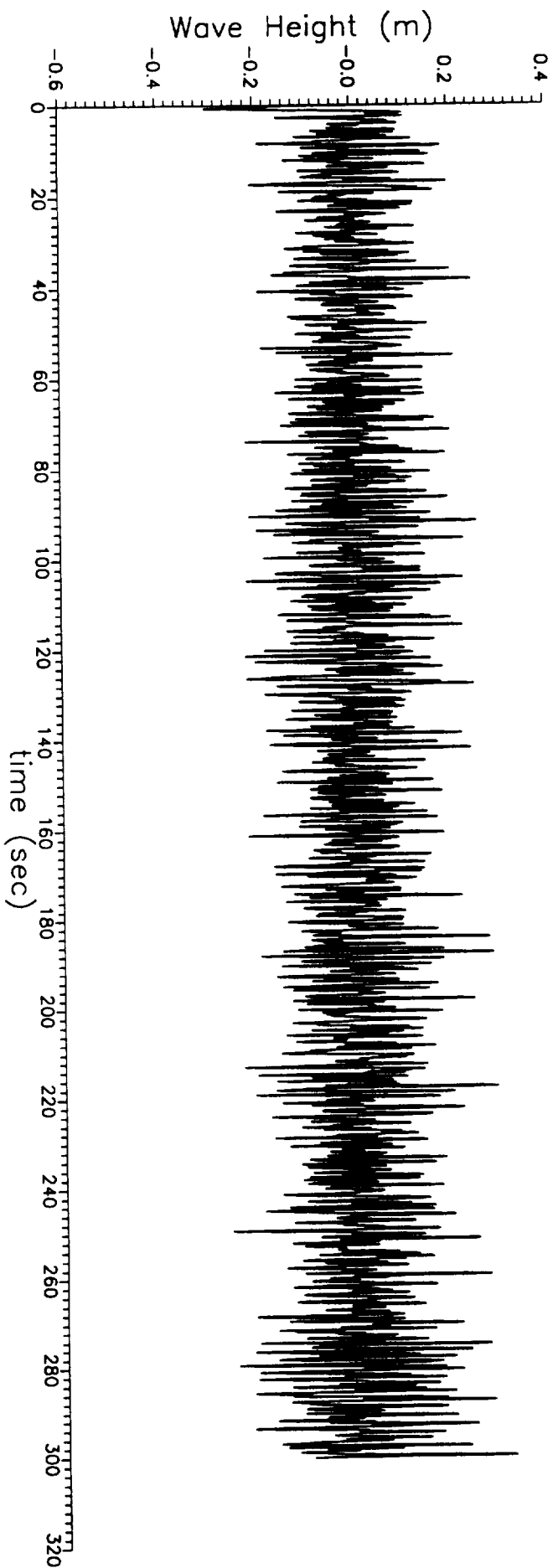
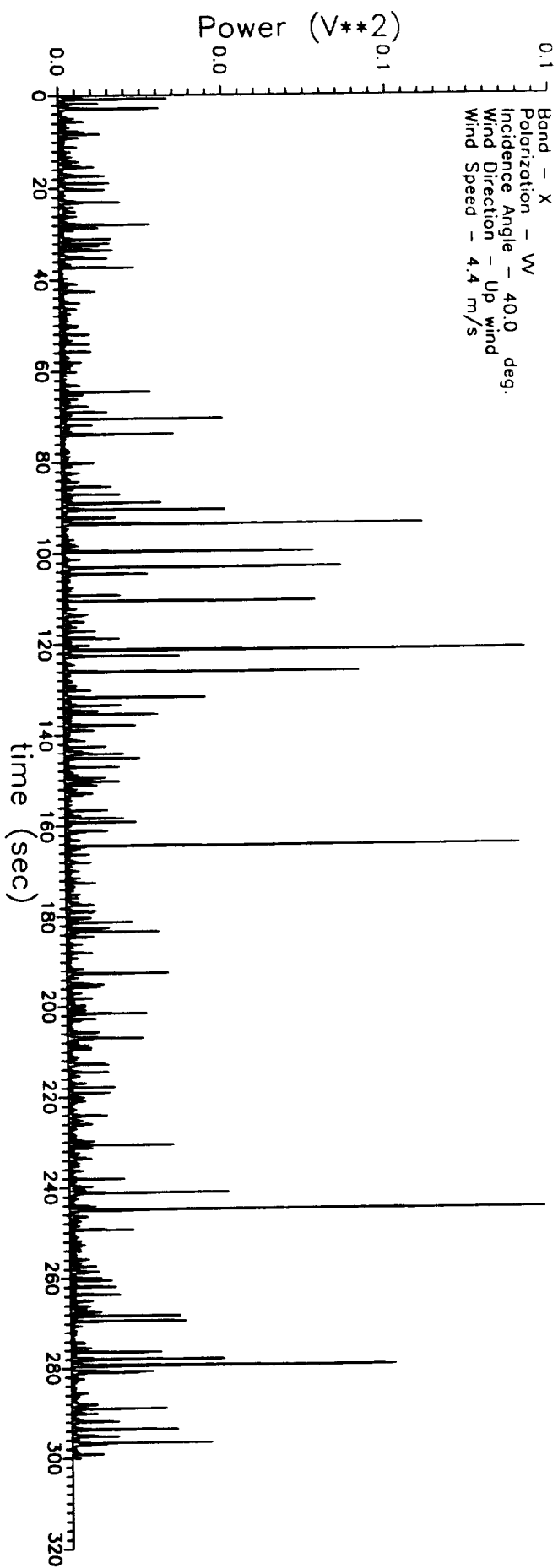


Run 11, 17:59, Aug 7, 1989

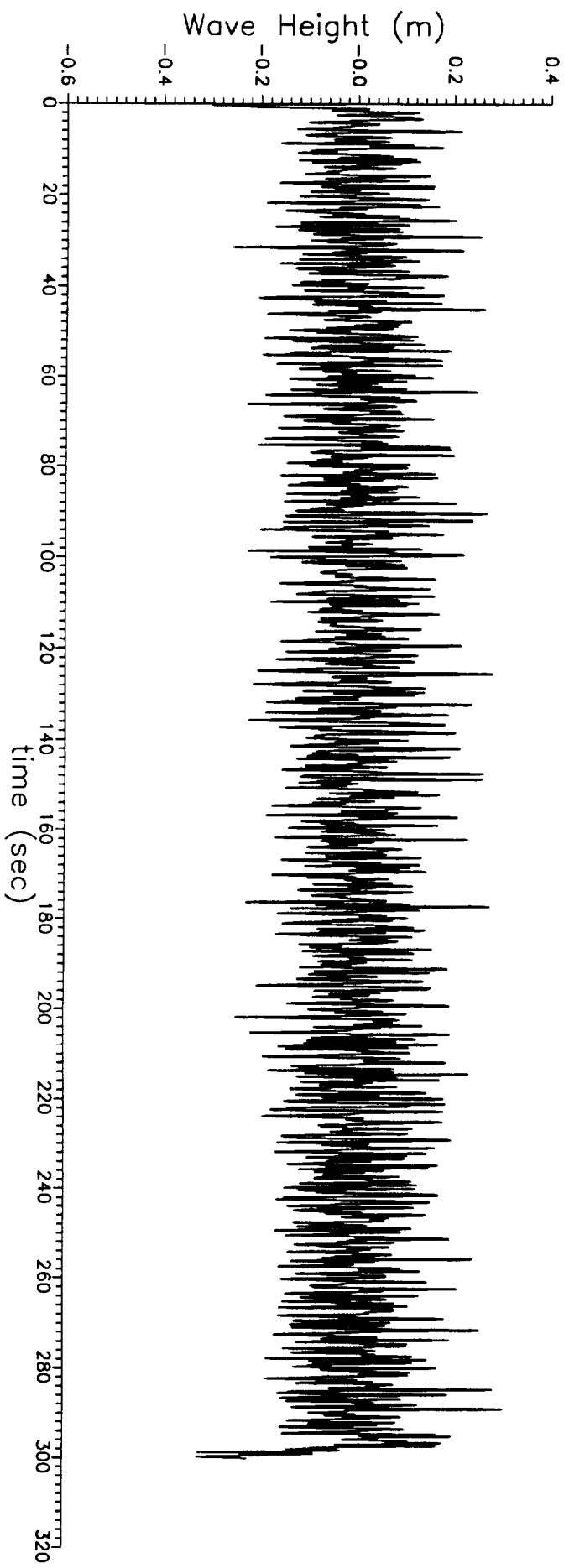
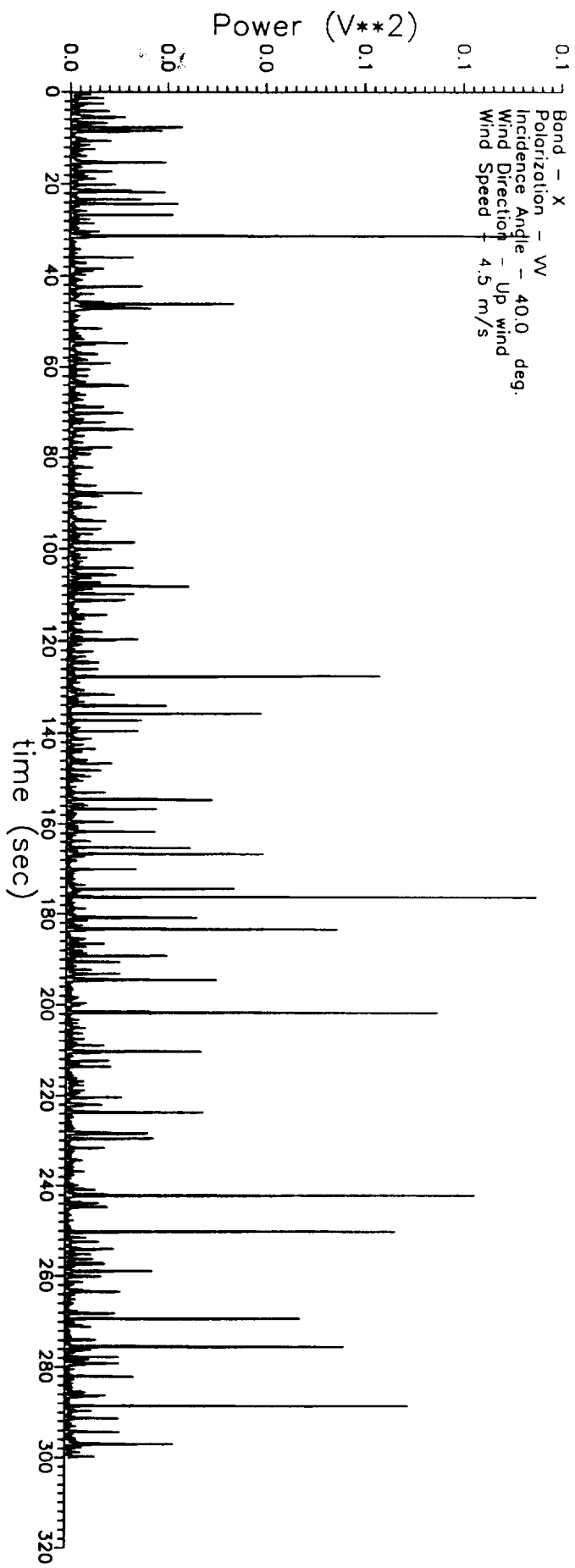
Band - X
Polarization - HH
Incidence Angle - 34.0 deg
Wind Direction - Cross wind
Wind Speed - 5.2 m/s



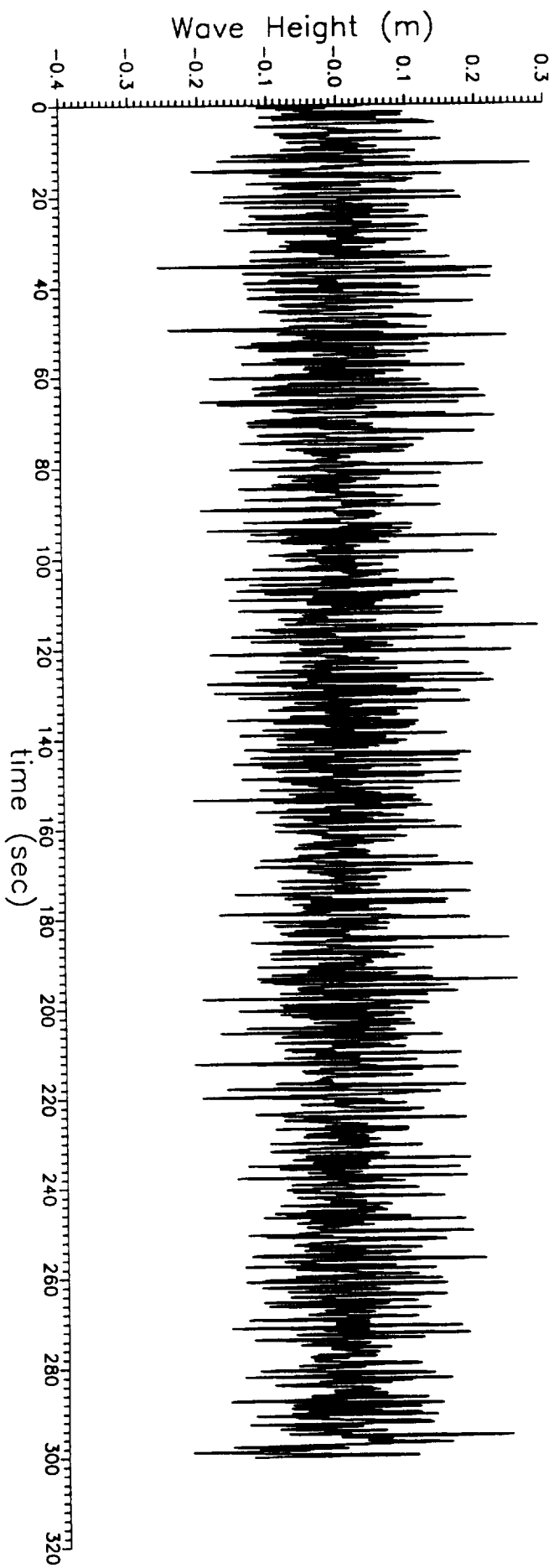
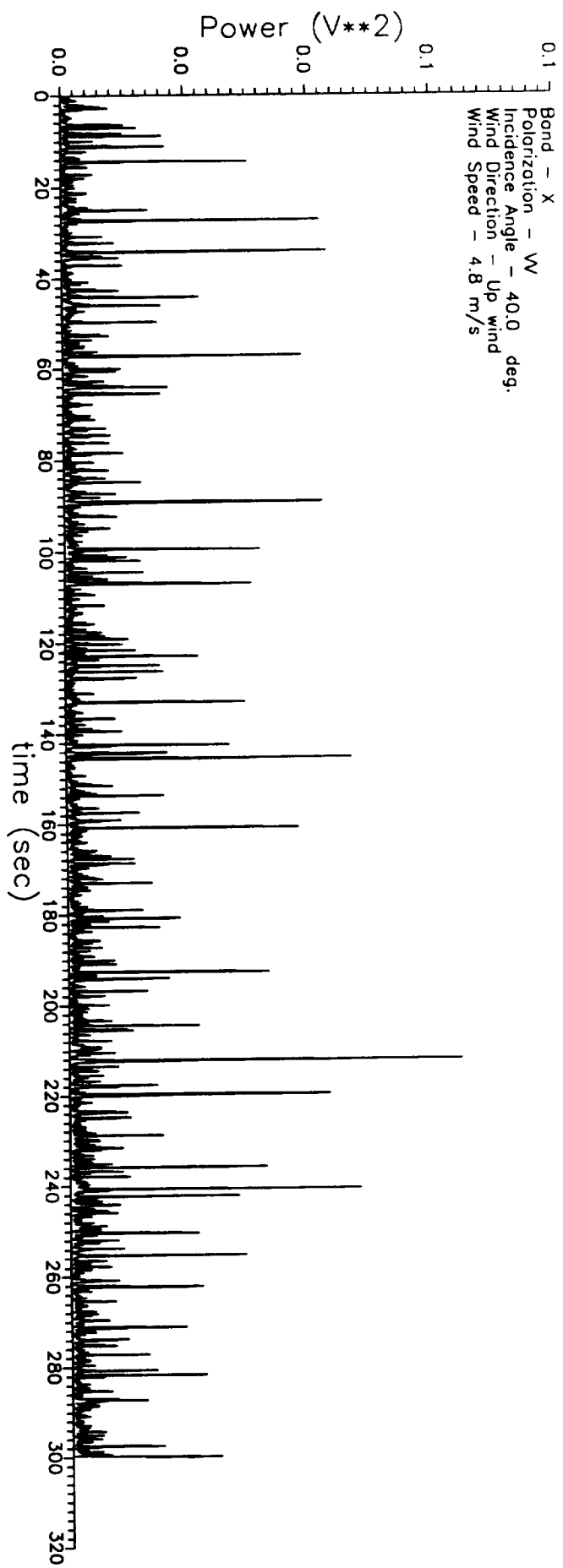
Run 12, 18:34, Aug 7, 1989



Run 13, 18:39, Aug 7, 1989

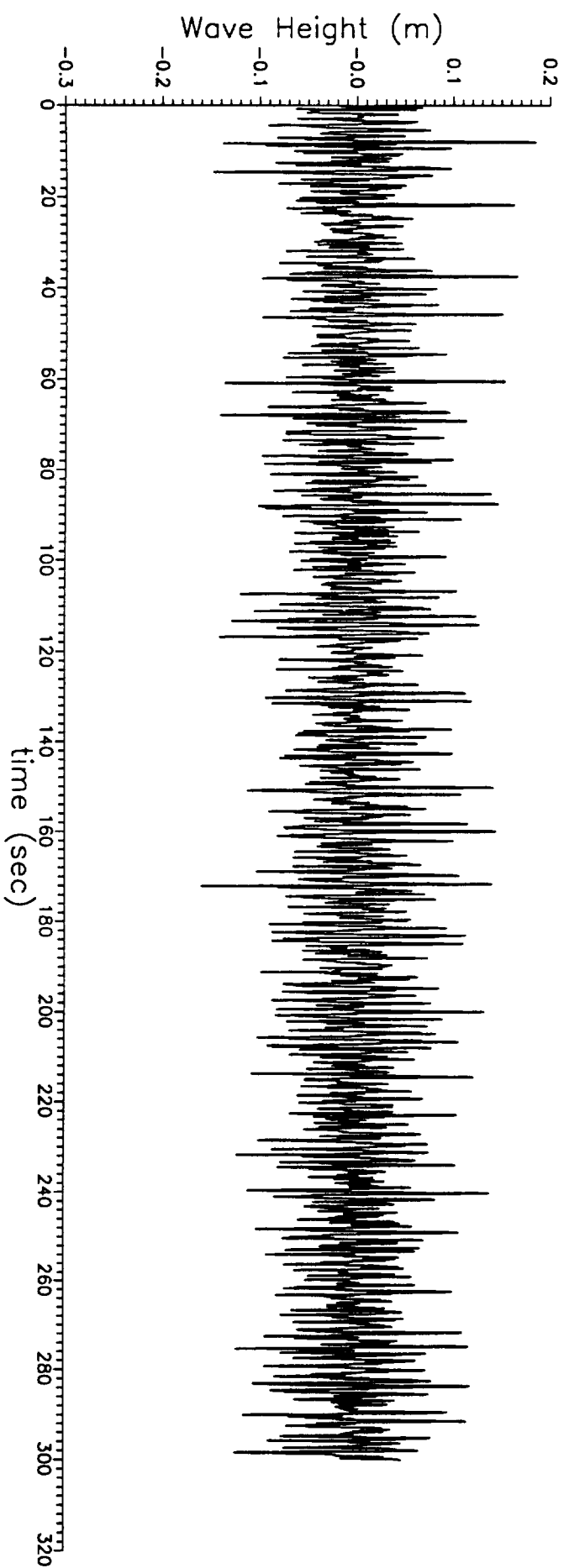
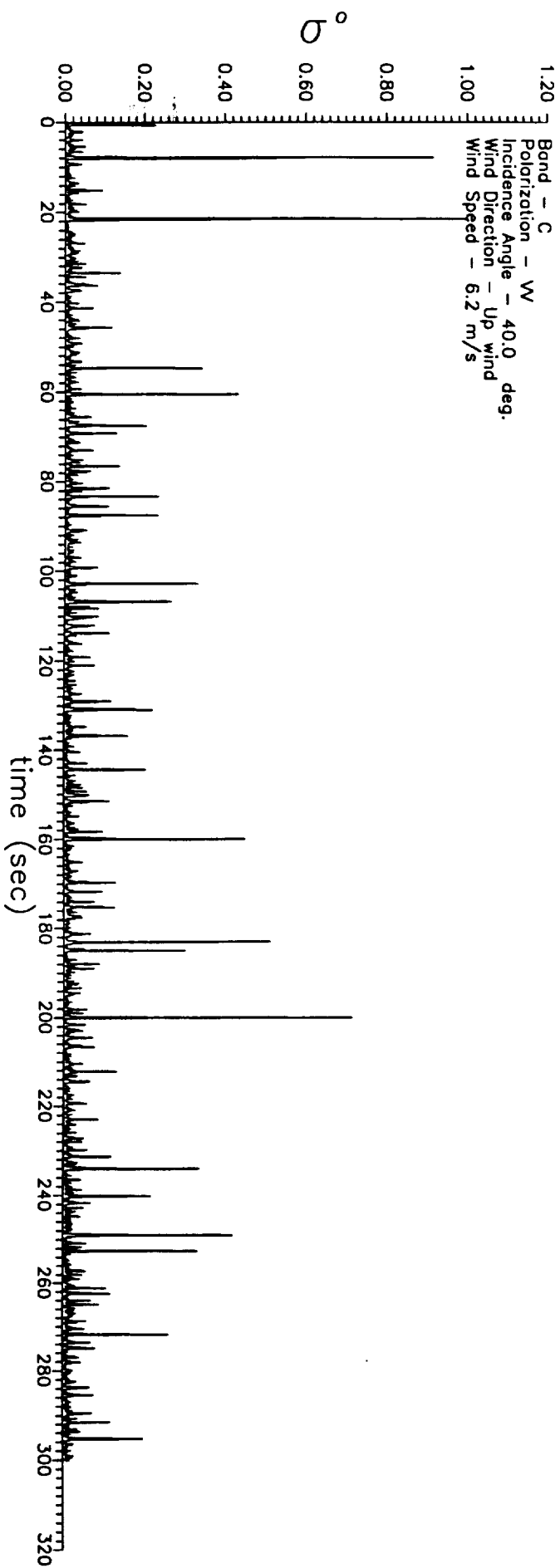


Run 14, 18:45, Aug 7, 1989

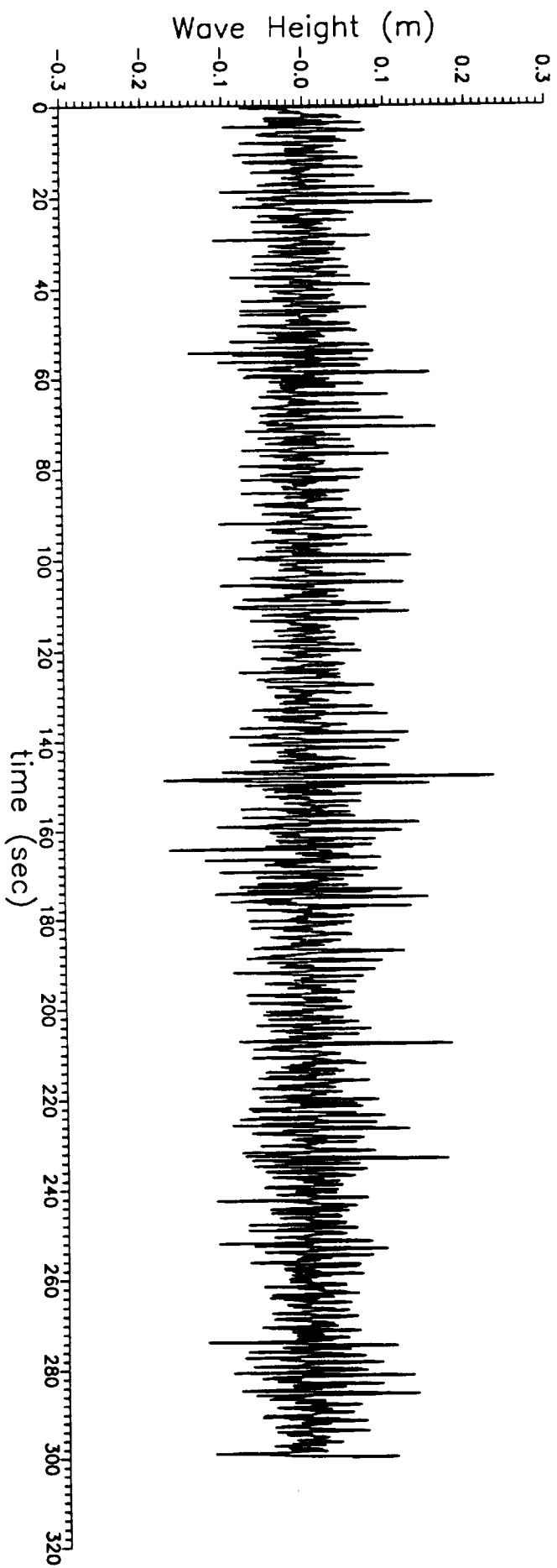
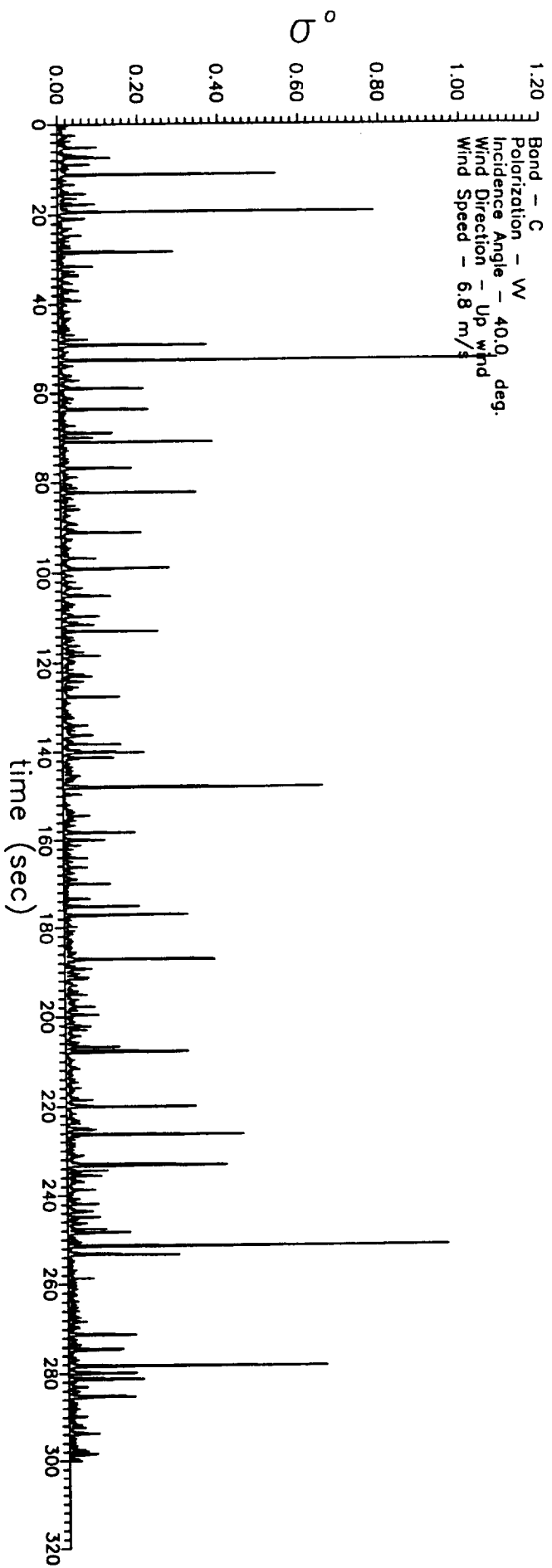


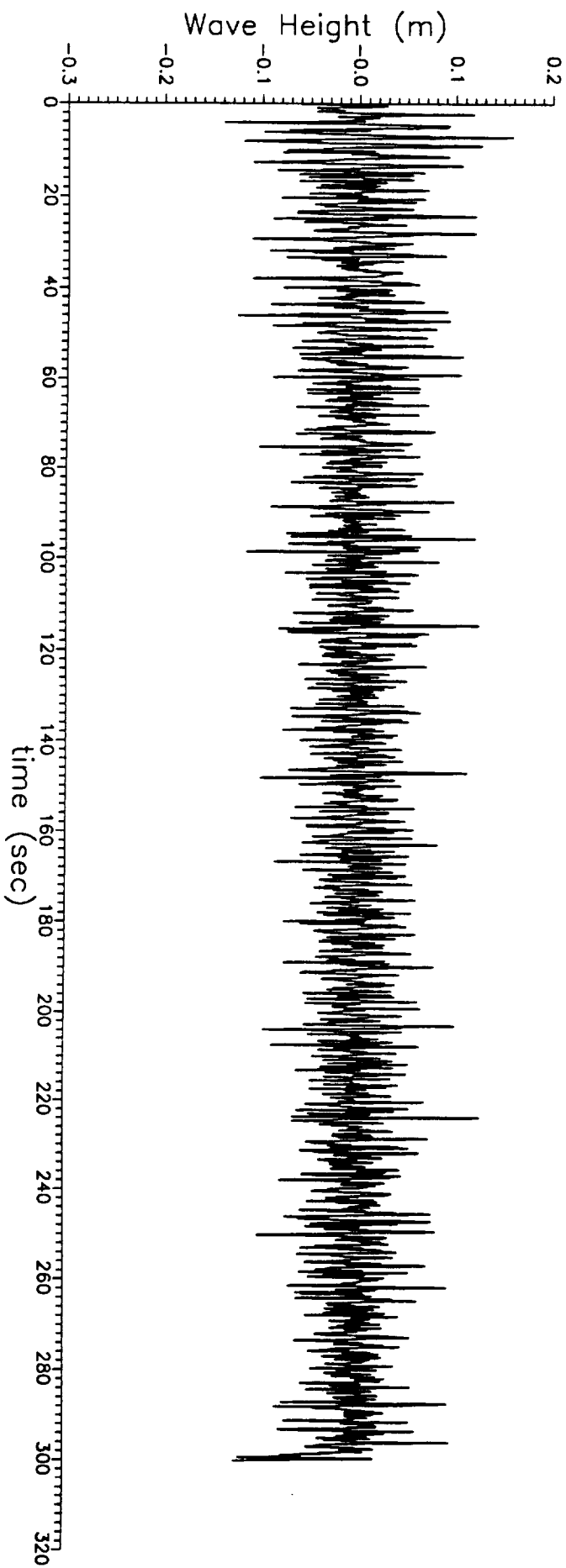
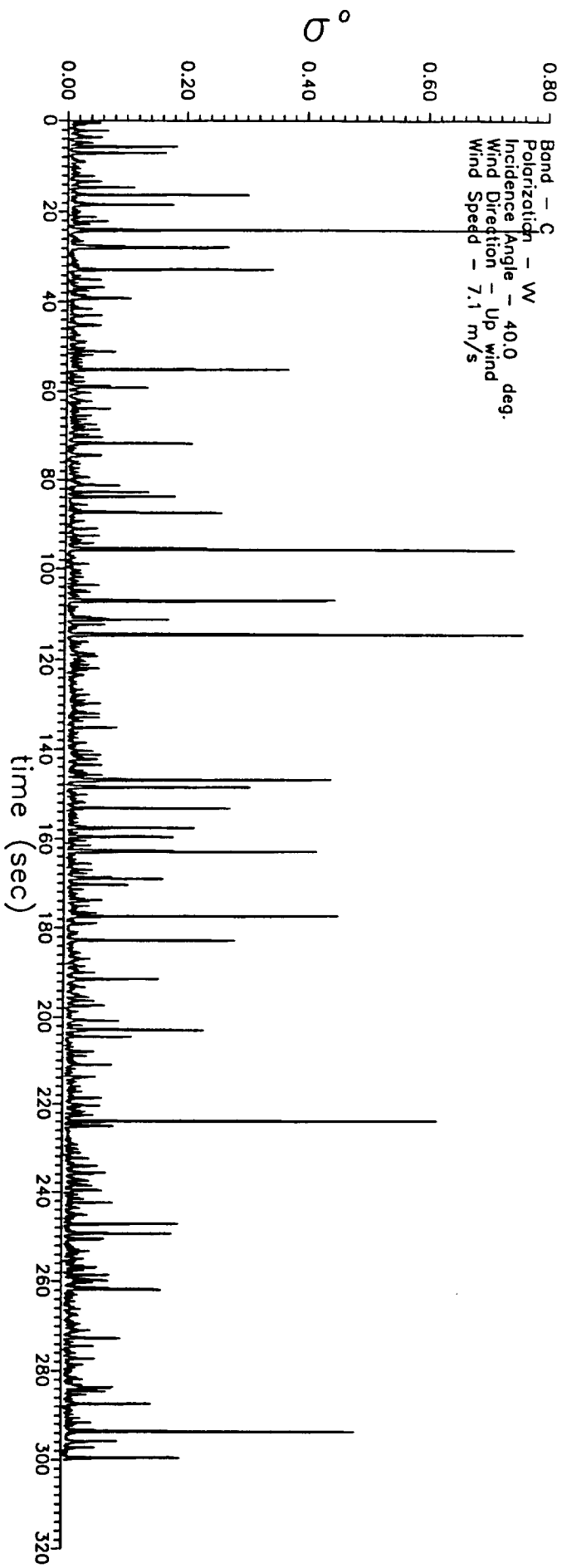
Run 19, 18:33, July 19, 1990

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.2 m/s



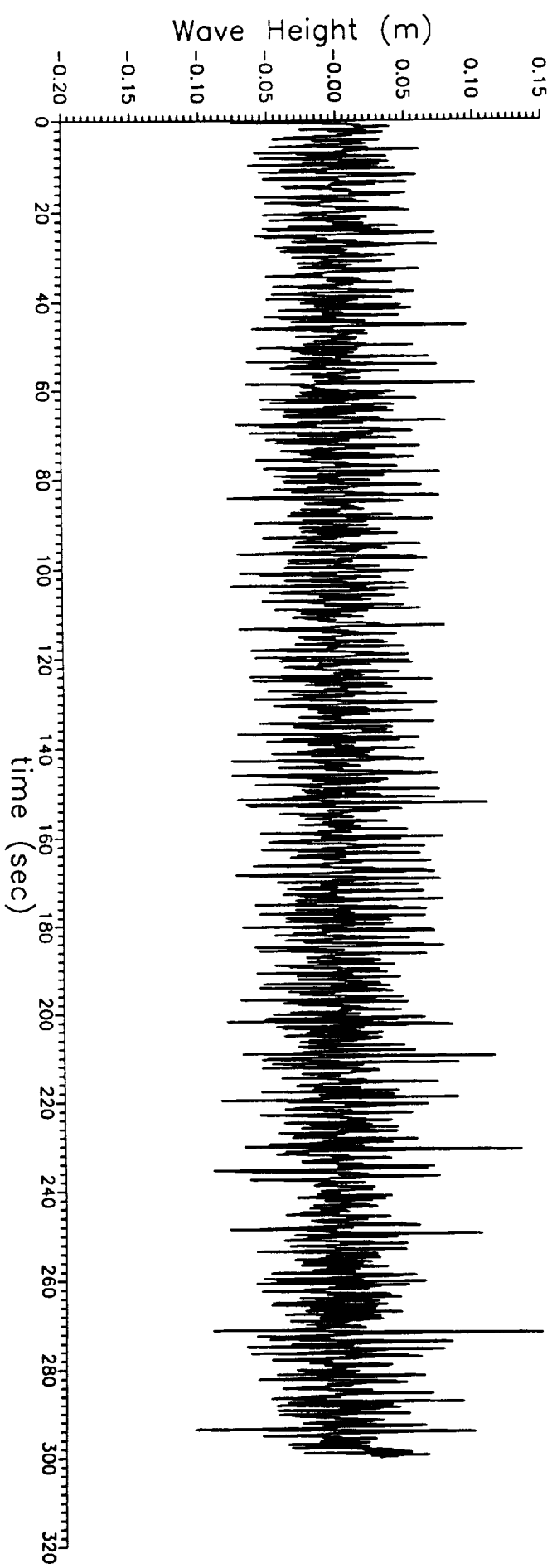
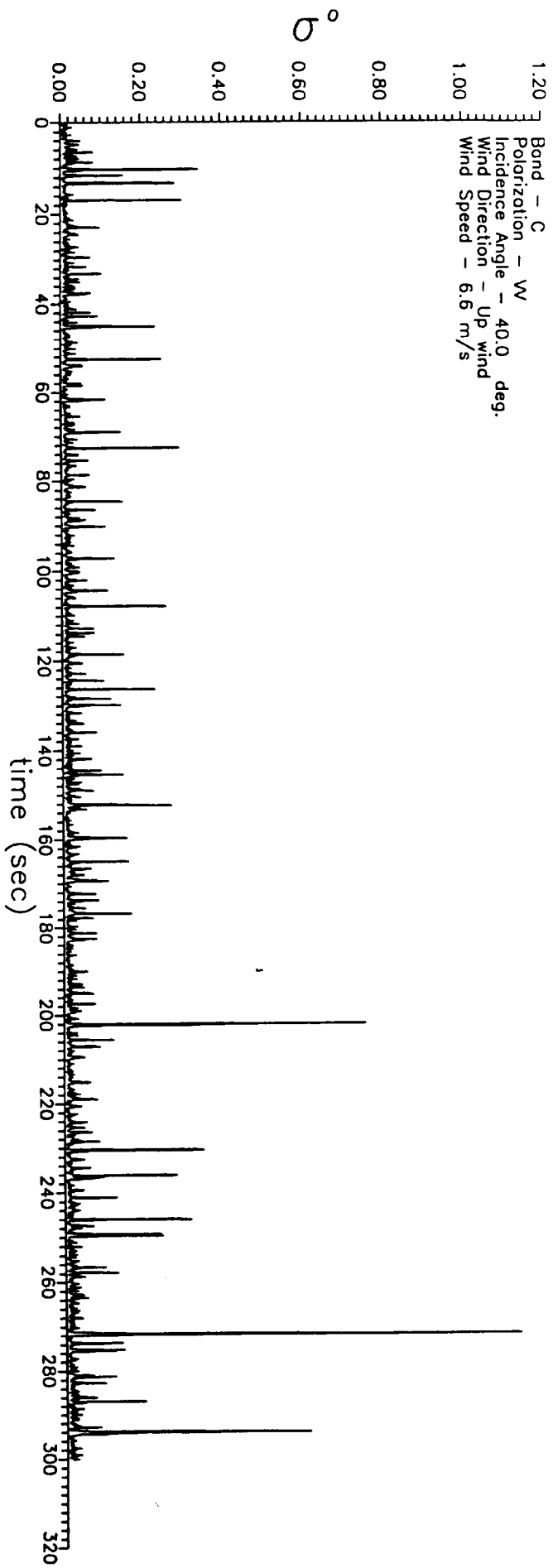
Run 20, 18:38, July 19, 1990





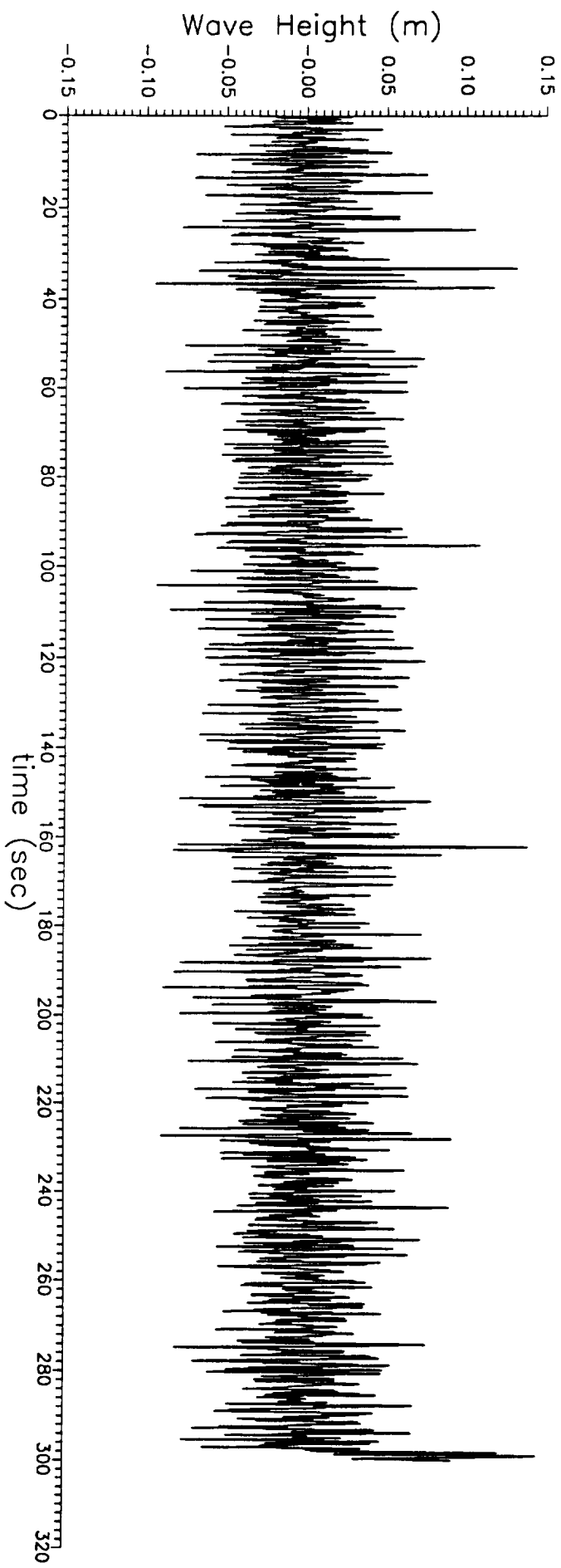
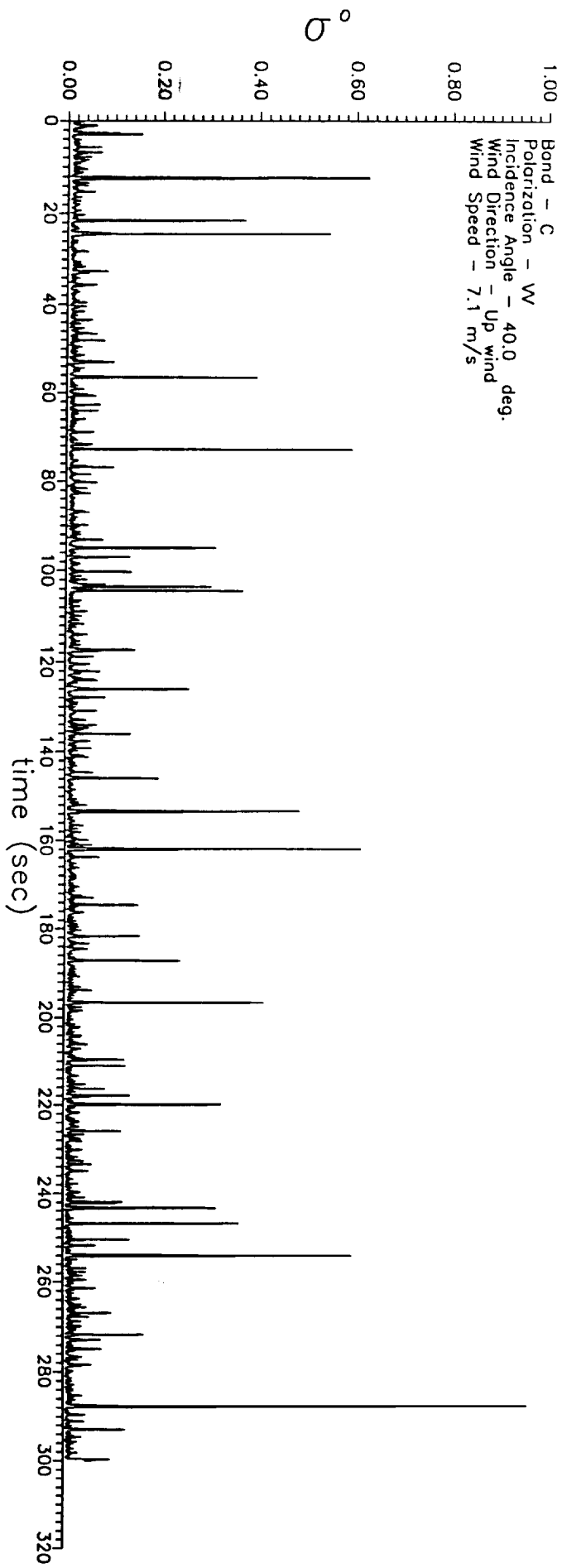
Run 22, 18:49, July 19, 1990

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



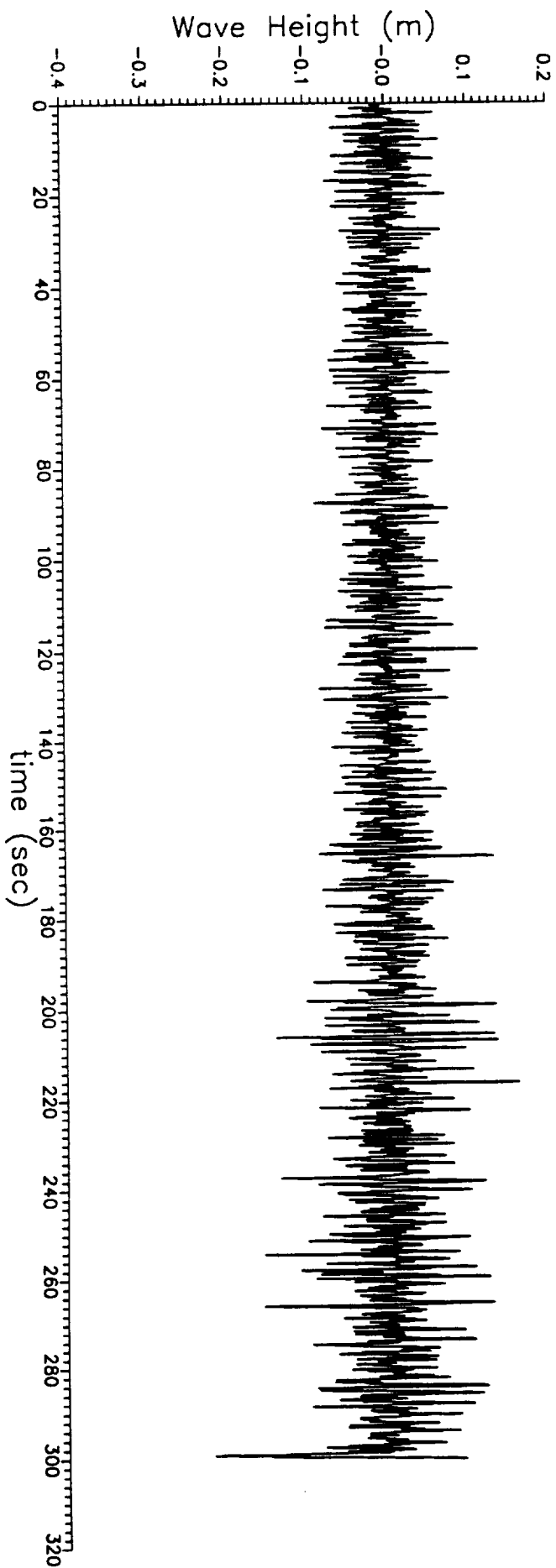
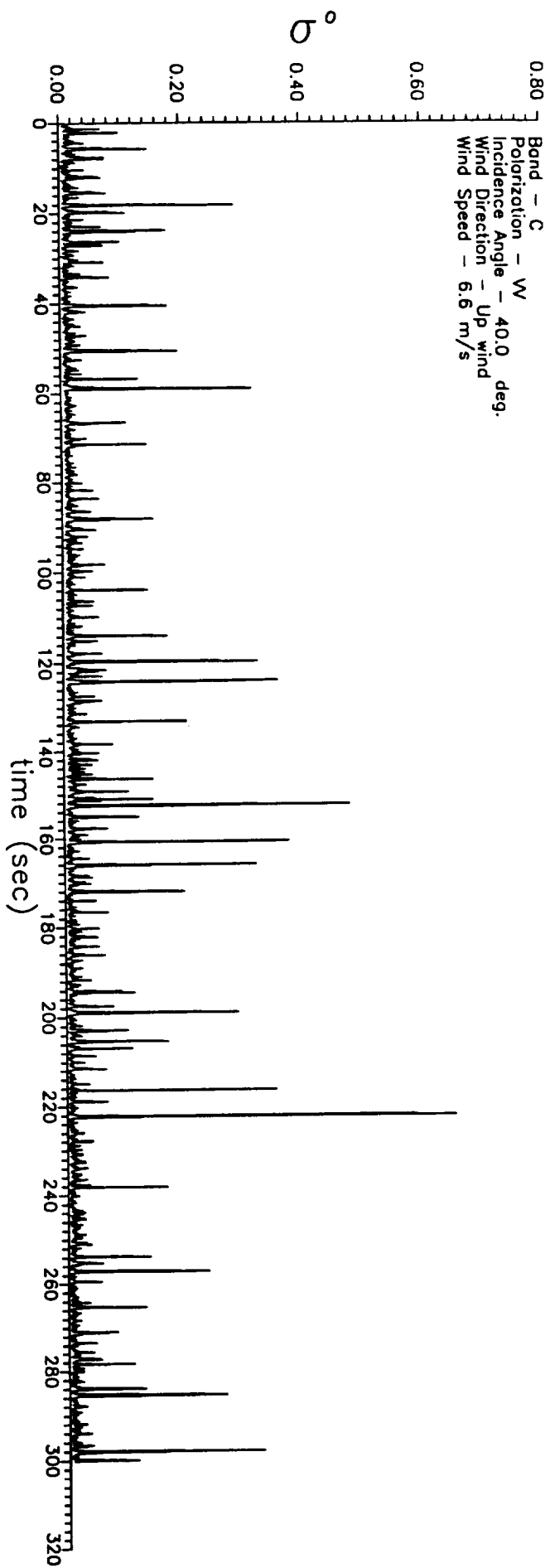
Run 23, 18:55, July 19, 1990

Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.1 m/s



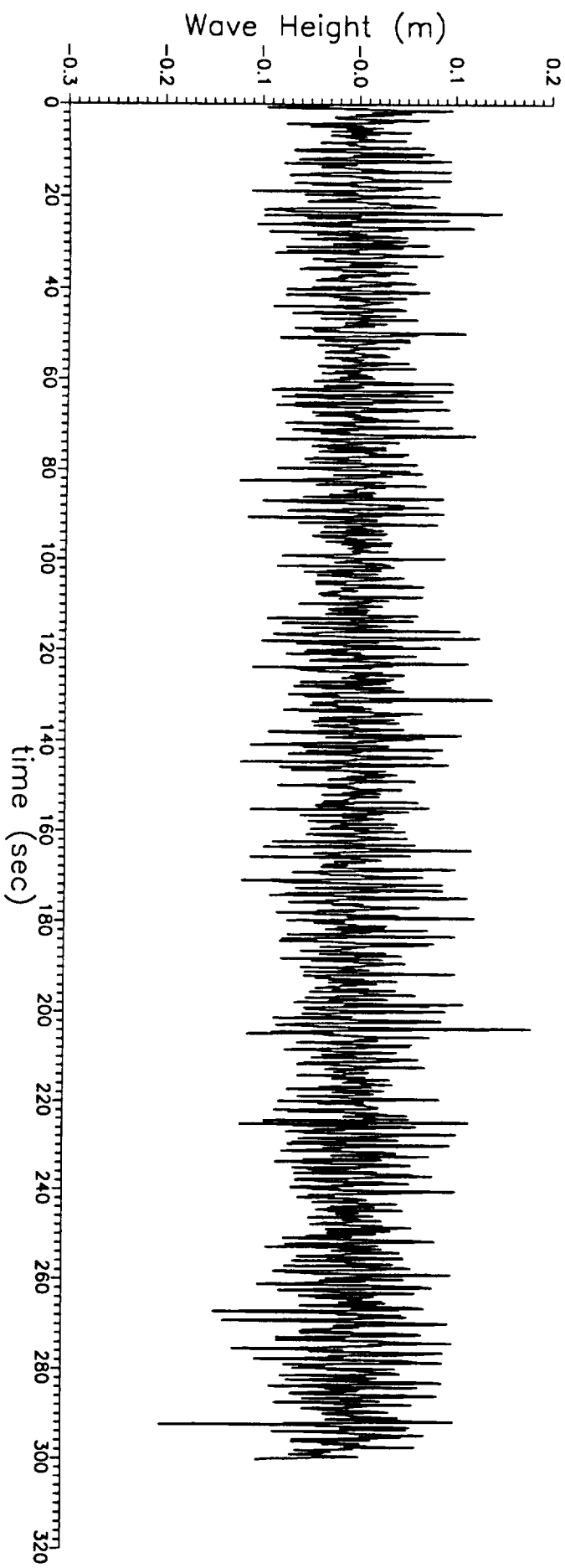
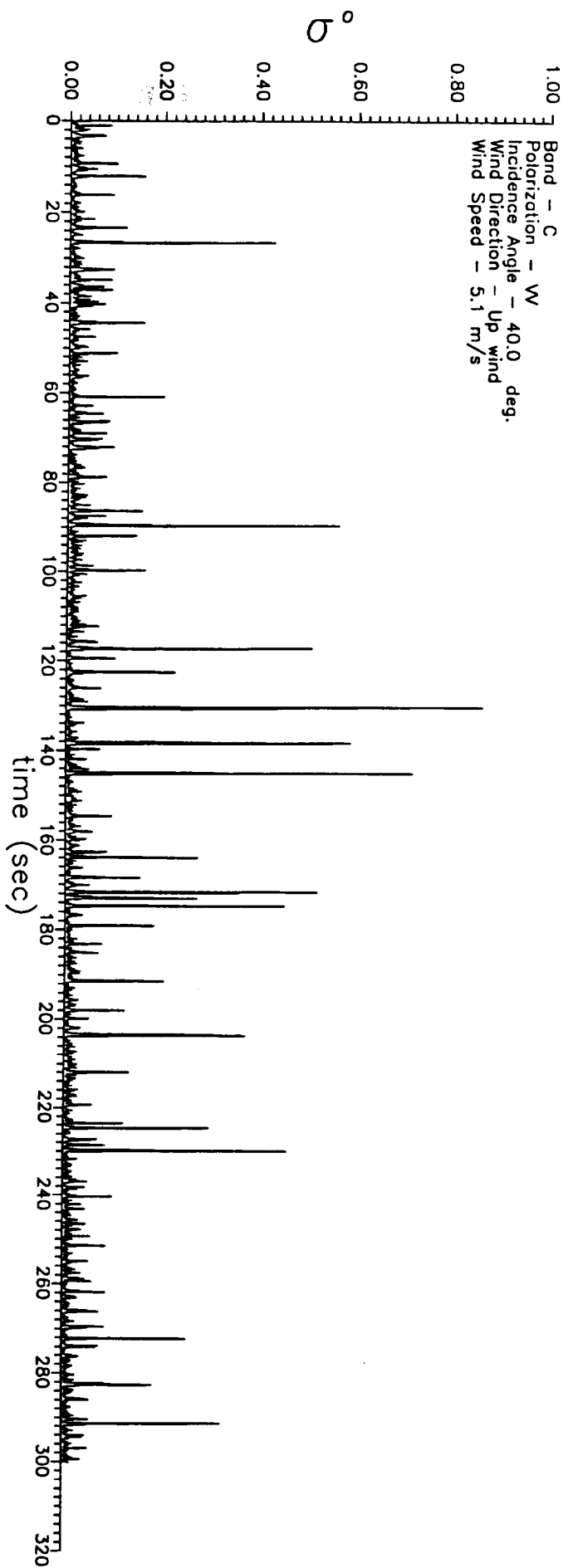
Run 24, 19:00, July 19, 1990

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s

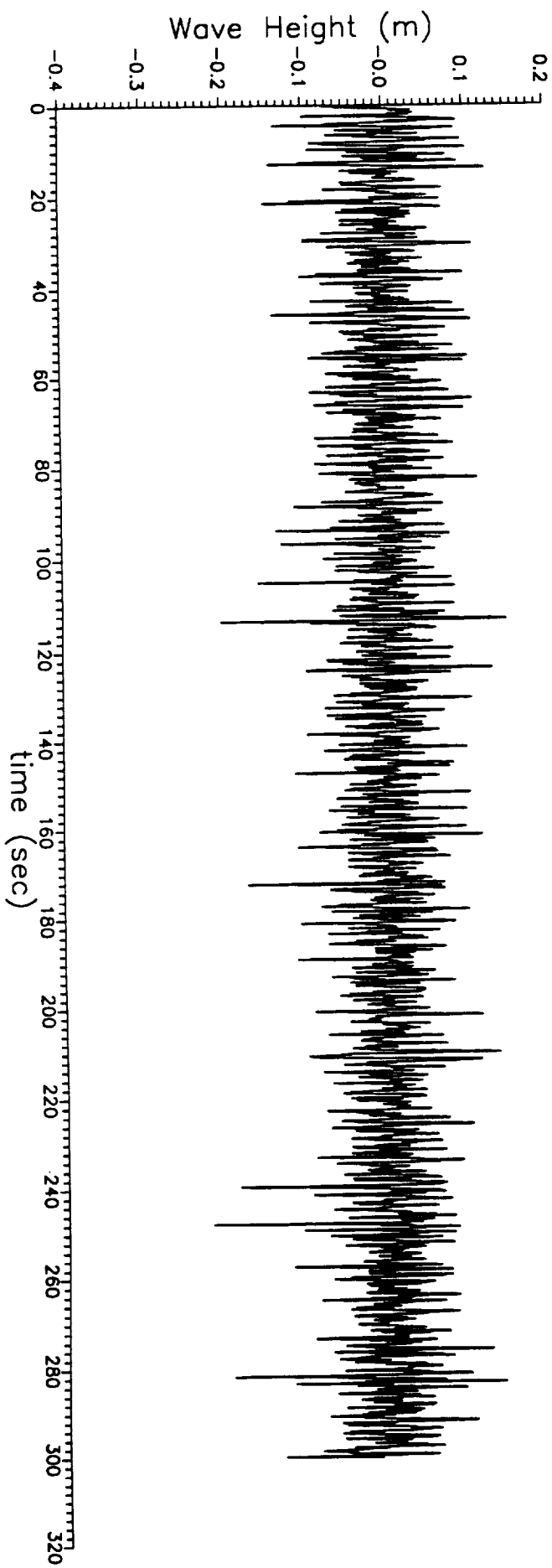
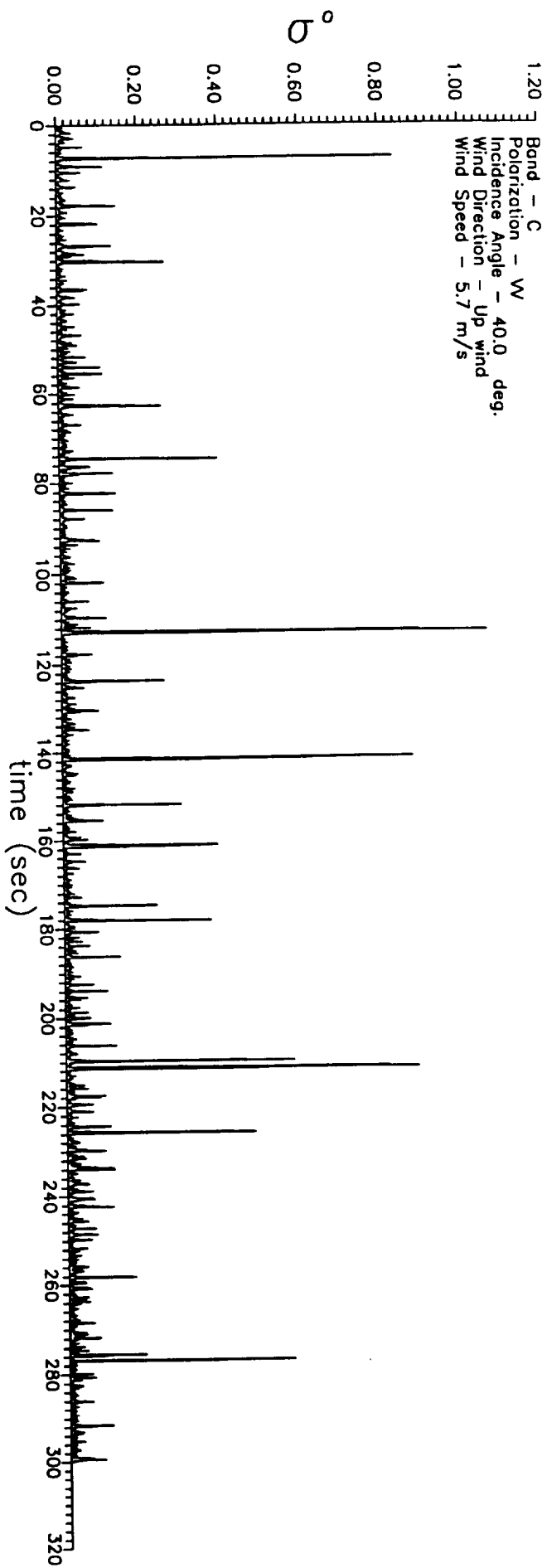


Run 25, 19:15, July 19, 1990

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.1 m/s

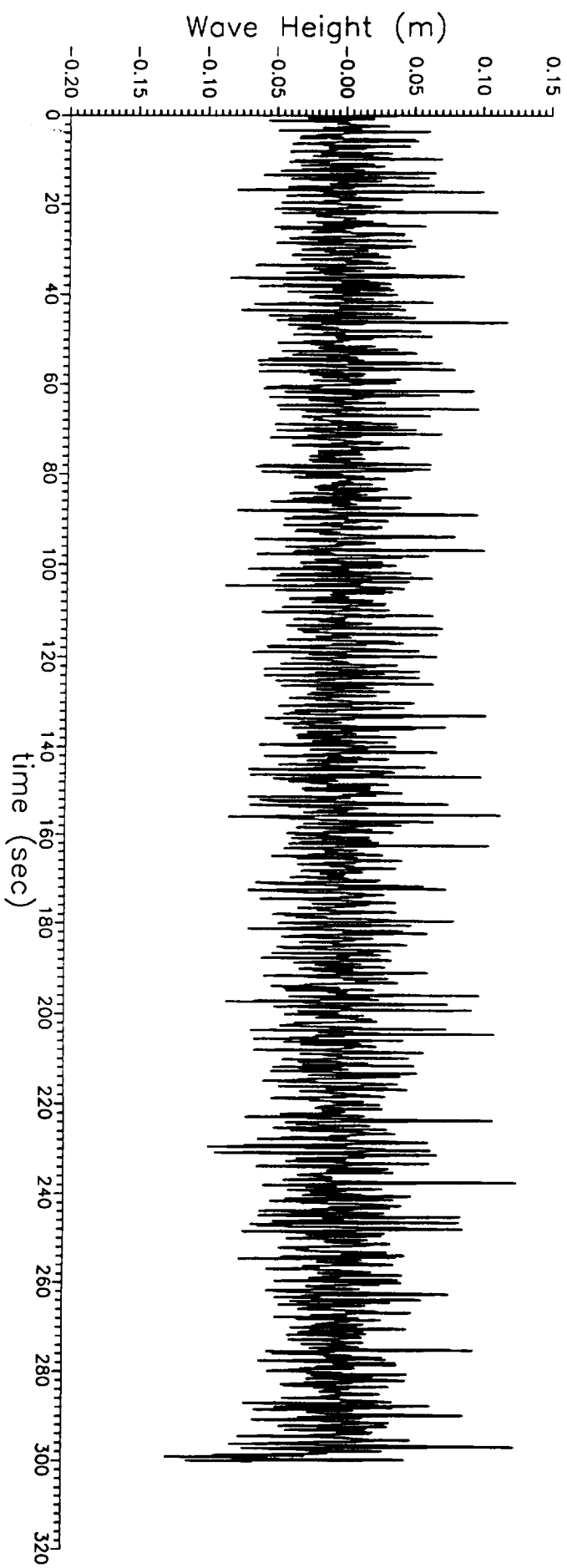
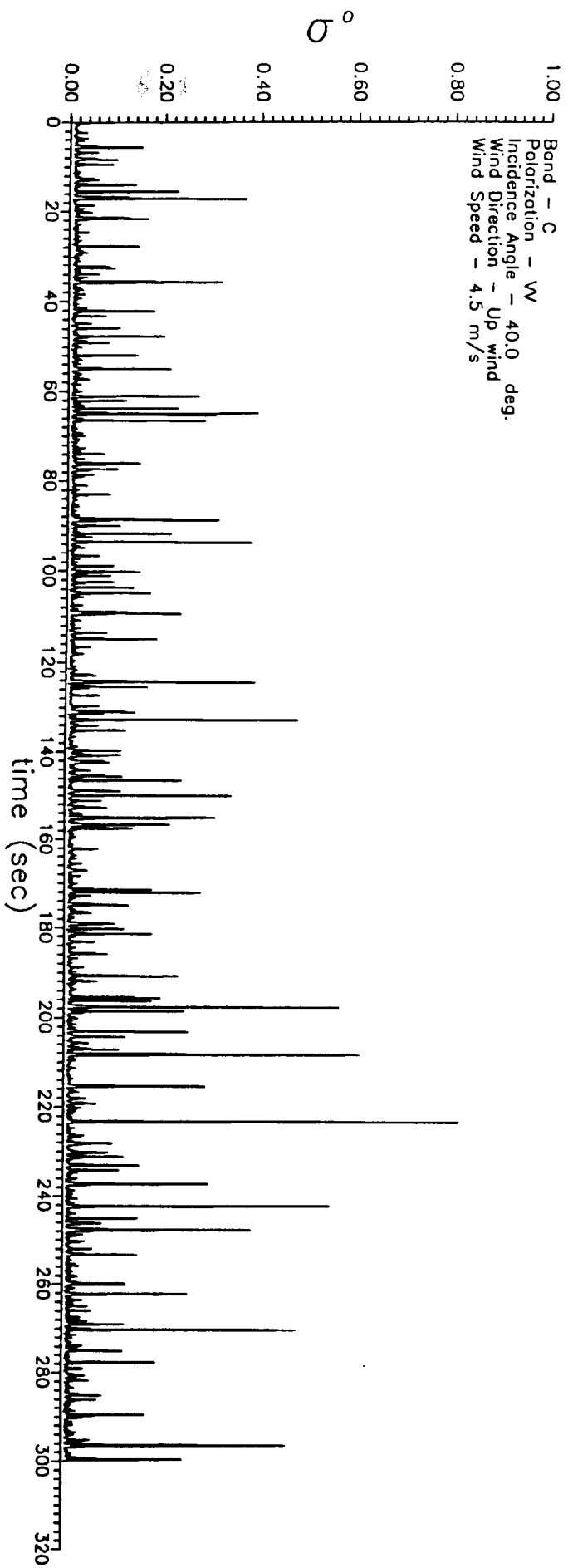


Run 26, 19:11, July 19, 1990

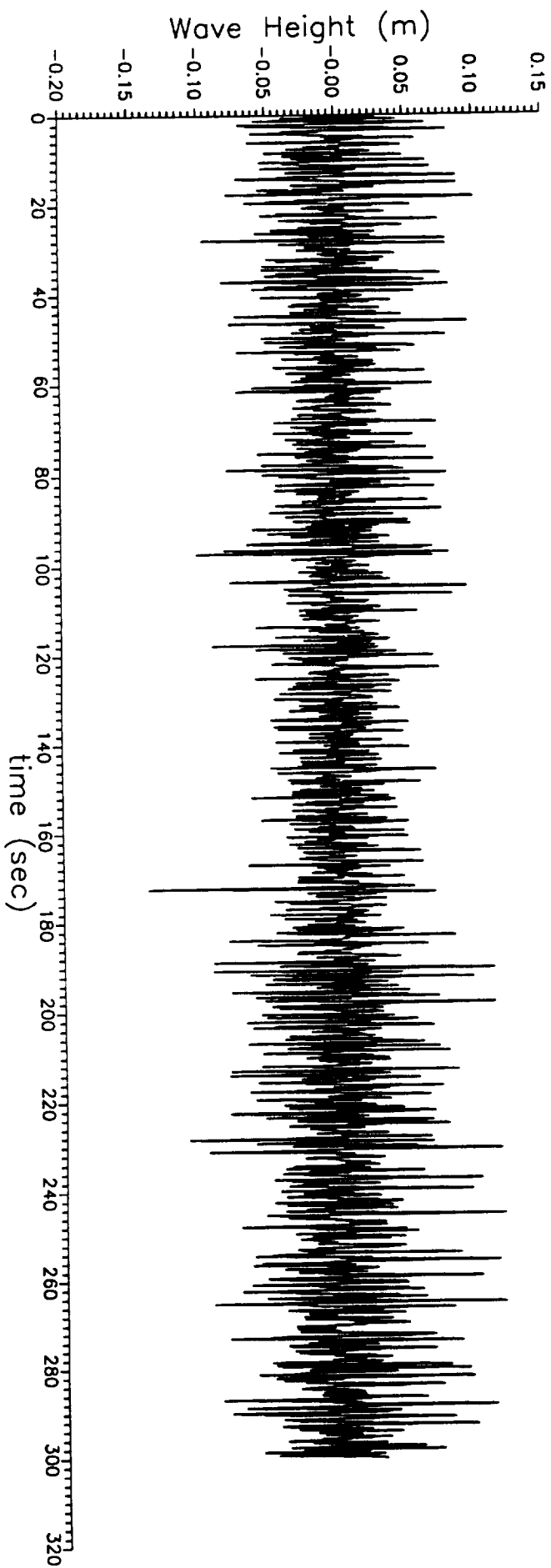
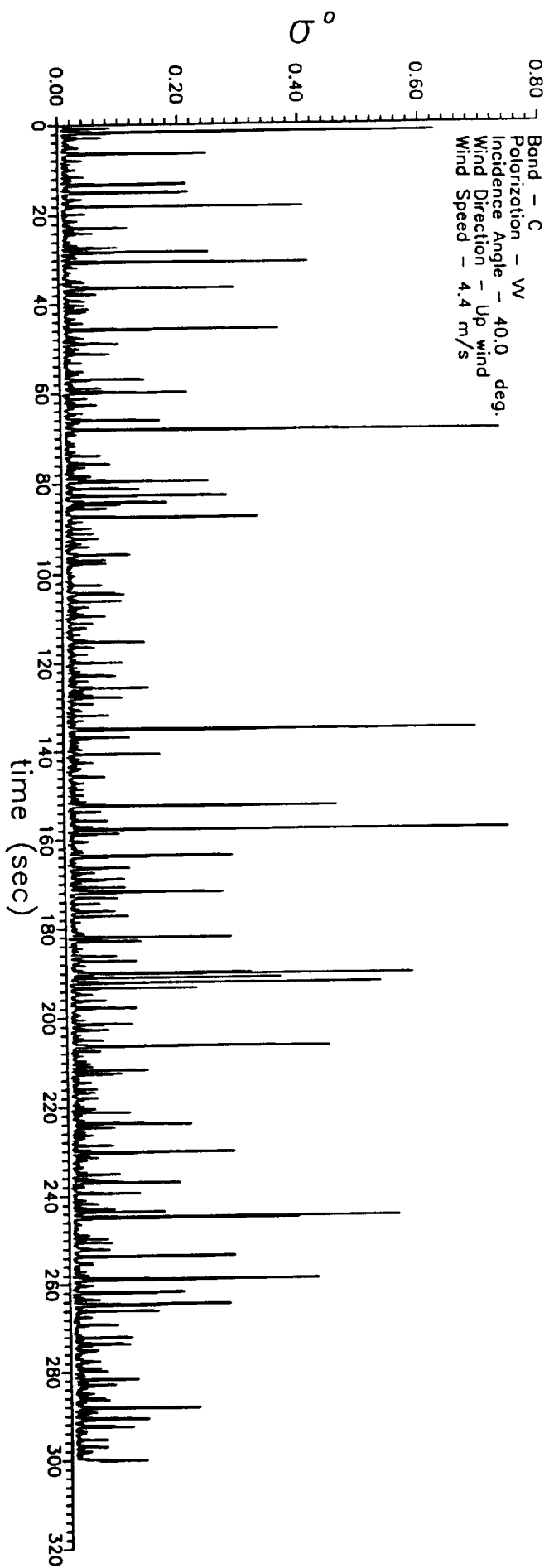


Run 9, 13:39, July 25, 1990

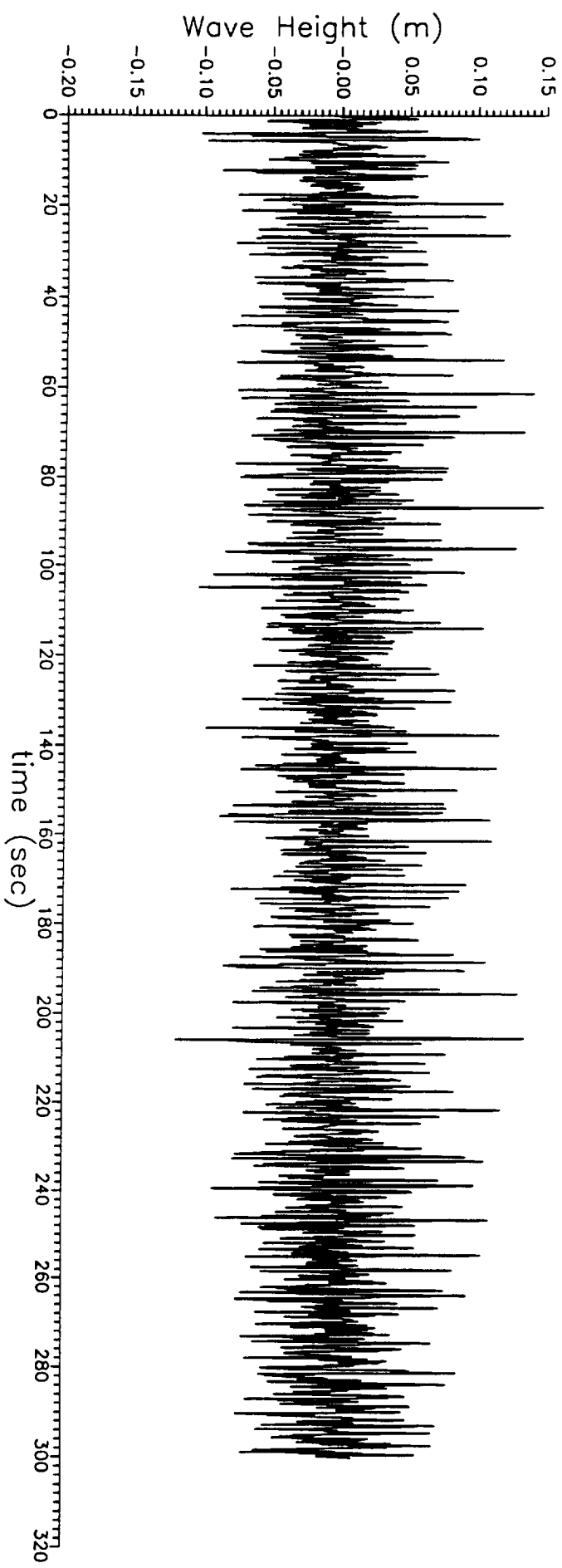
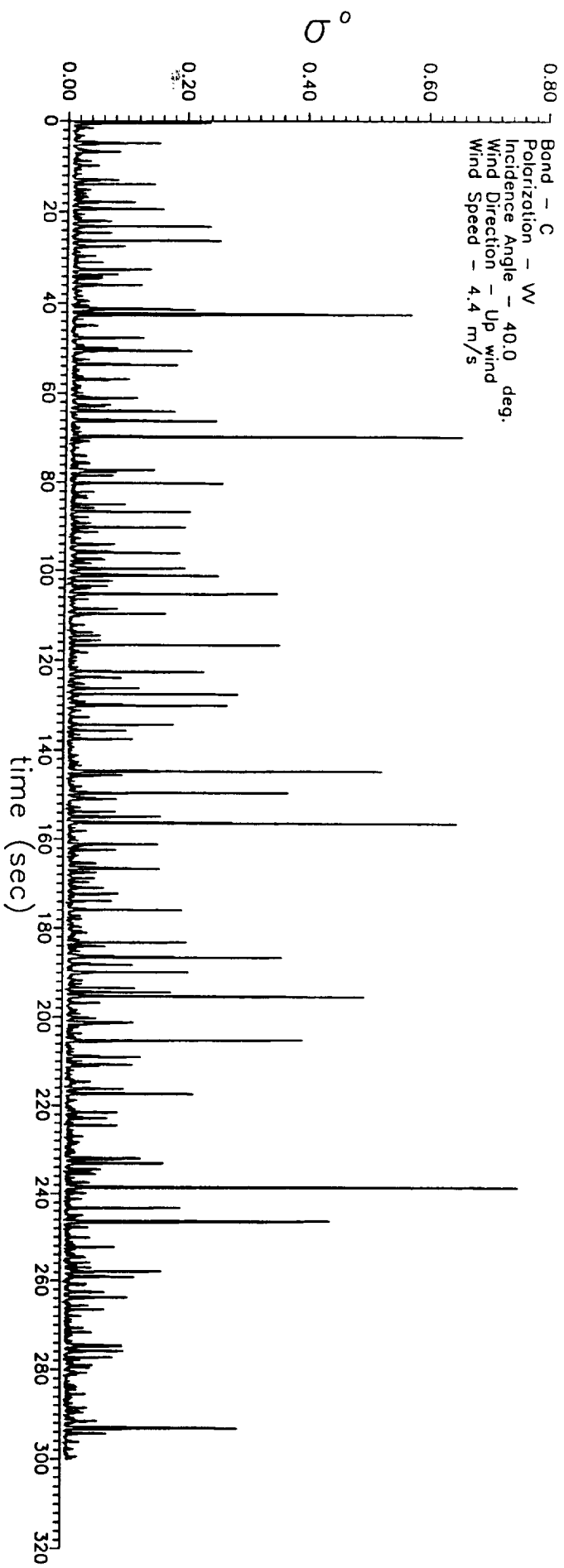
Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.5 m/s



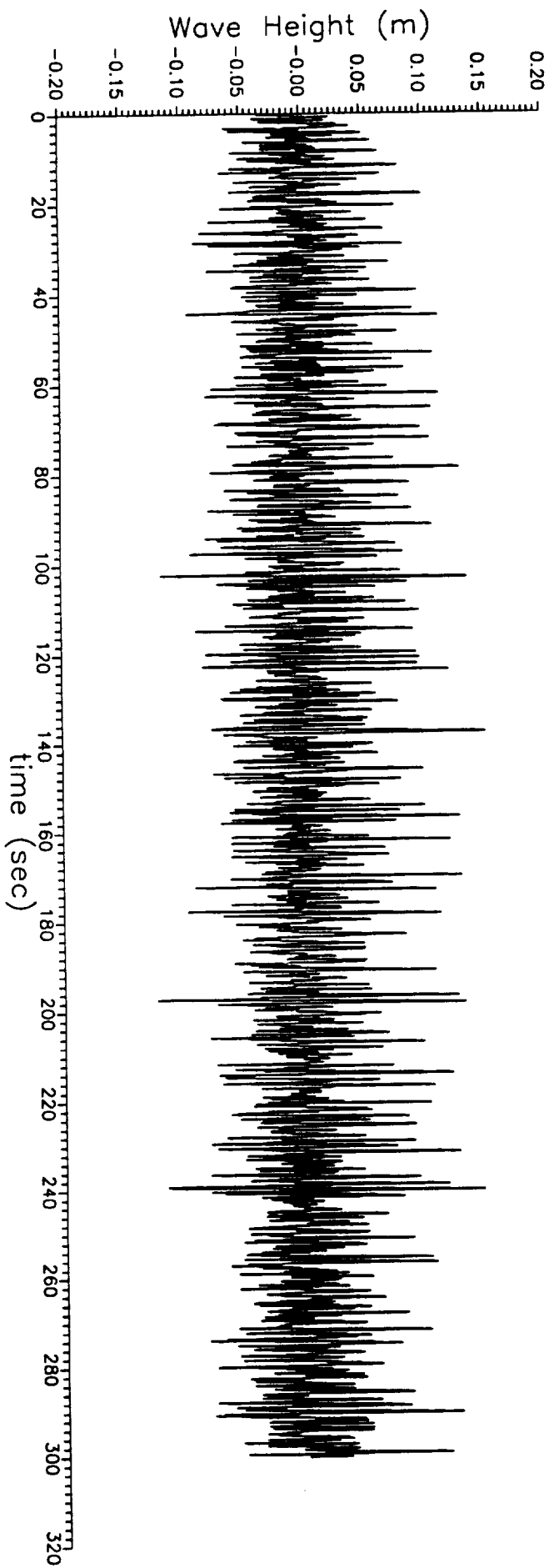
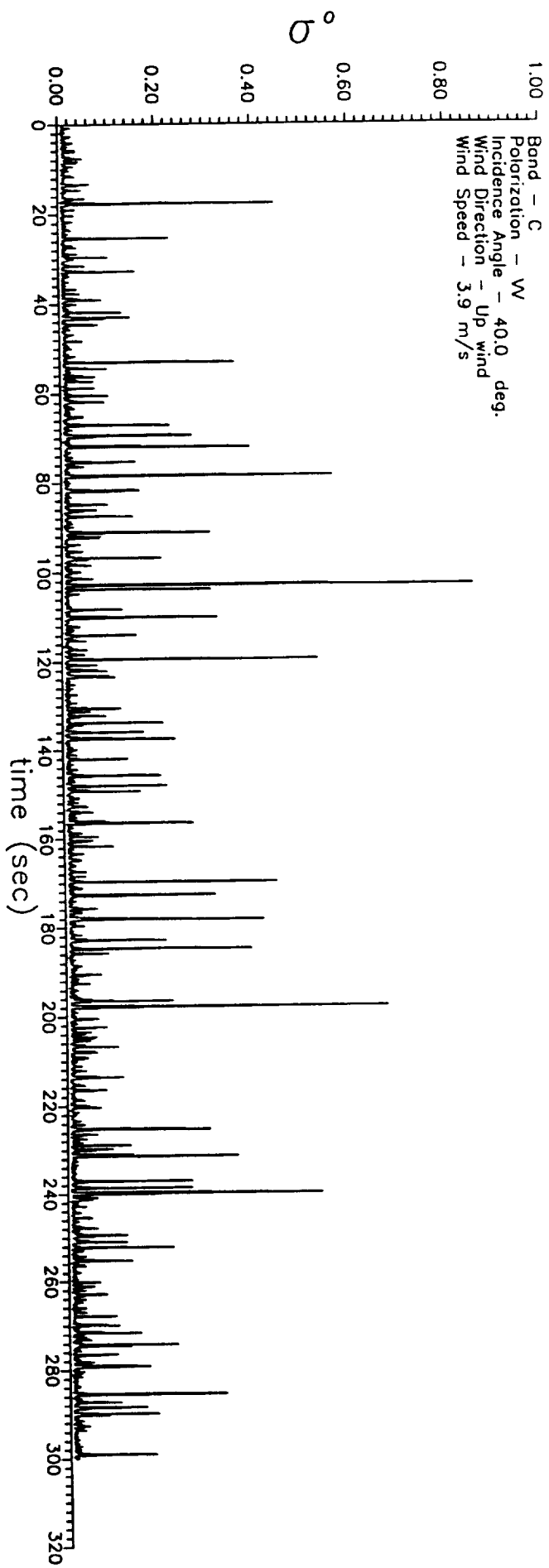
Run 11, 13:52, July 25, 1990



Run 12, 113:58, July 25, 1990

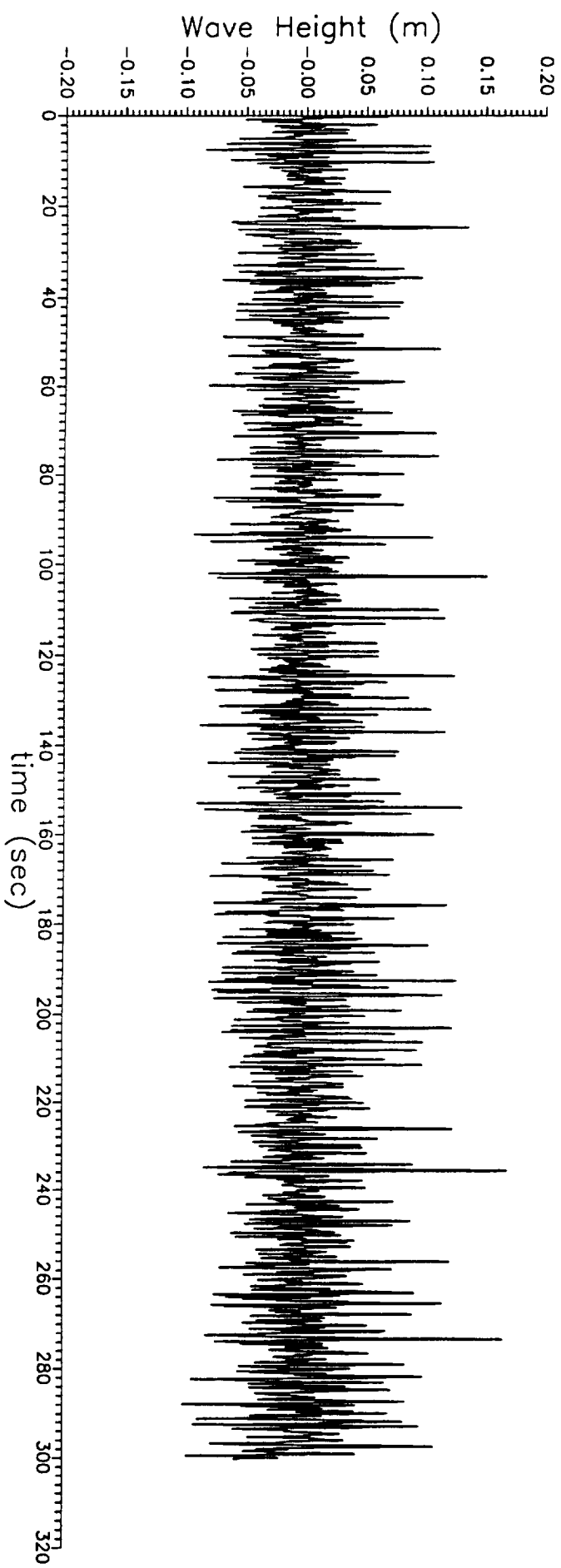
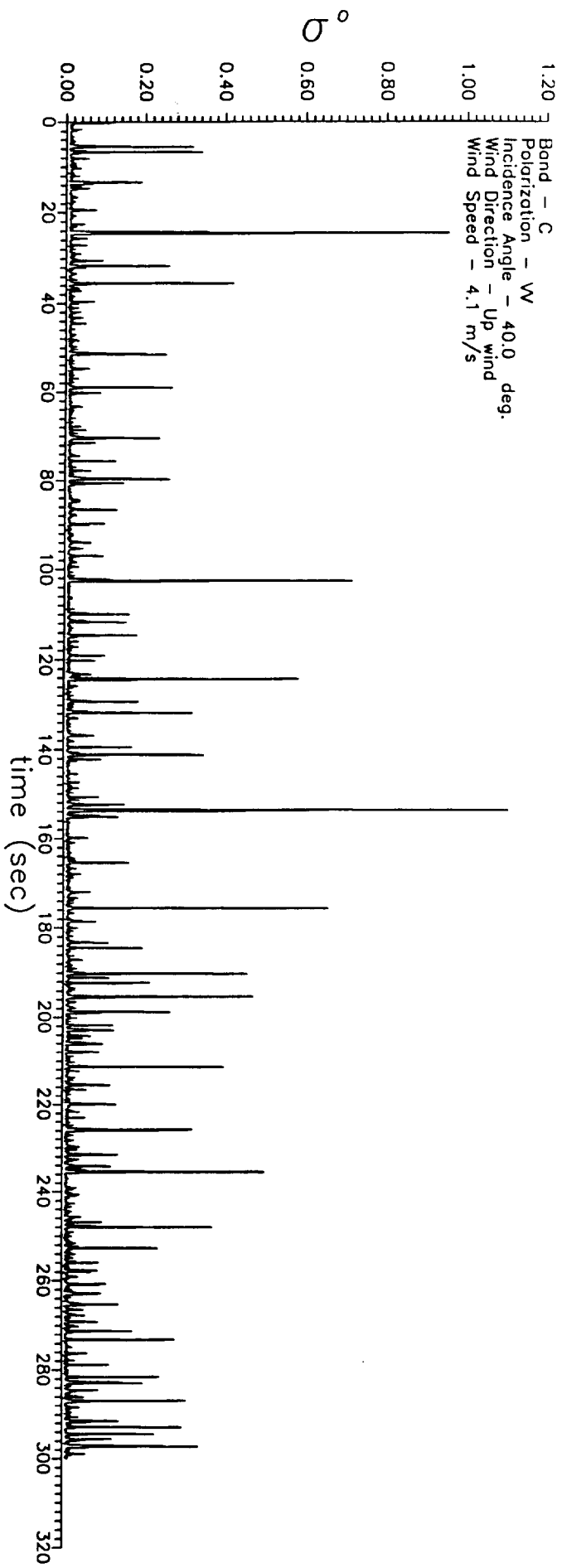


Run 13, 14:03, July 25, 1990

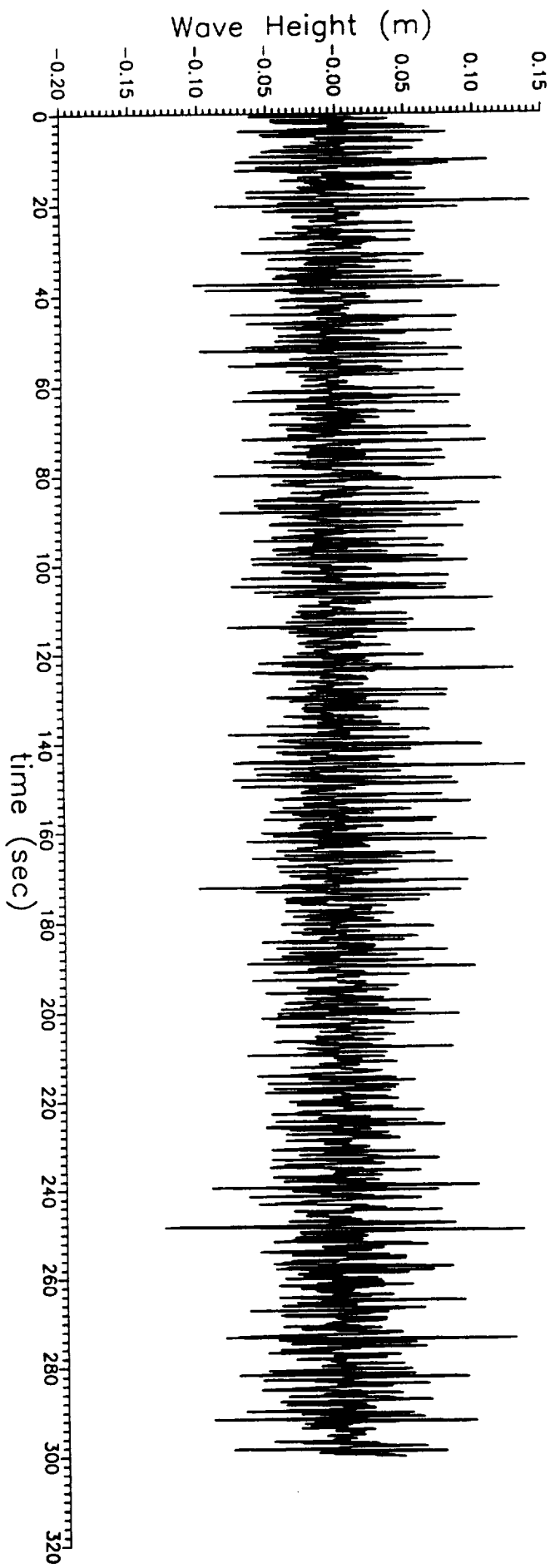
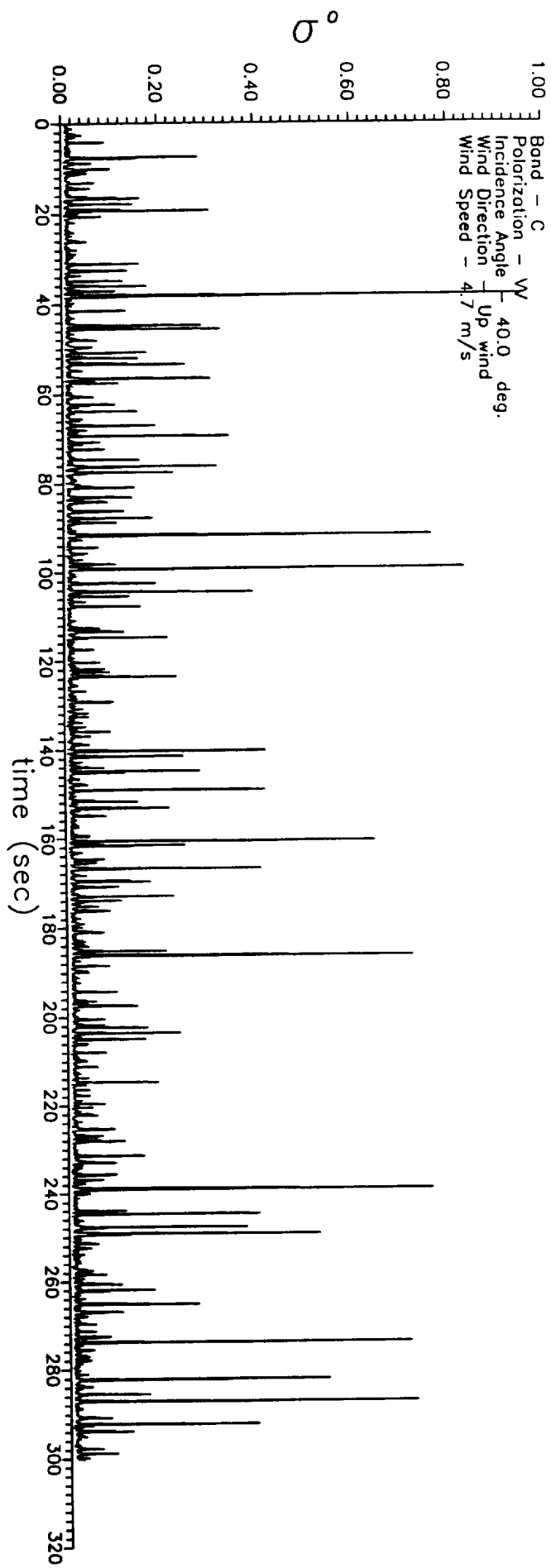


Run 14, 14:08, July 25, 1990

Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.1 m/s

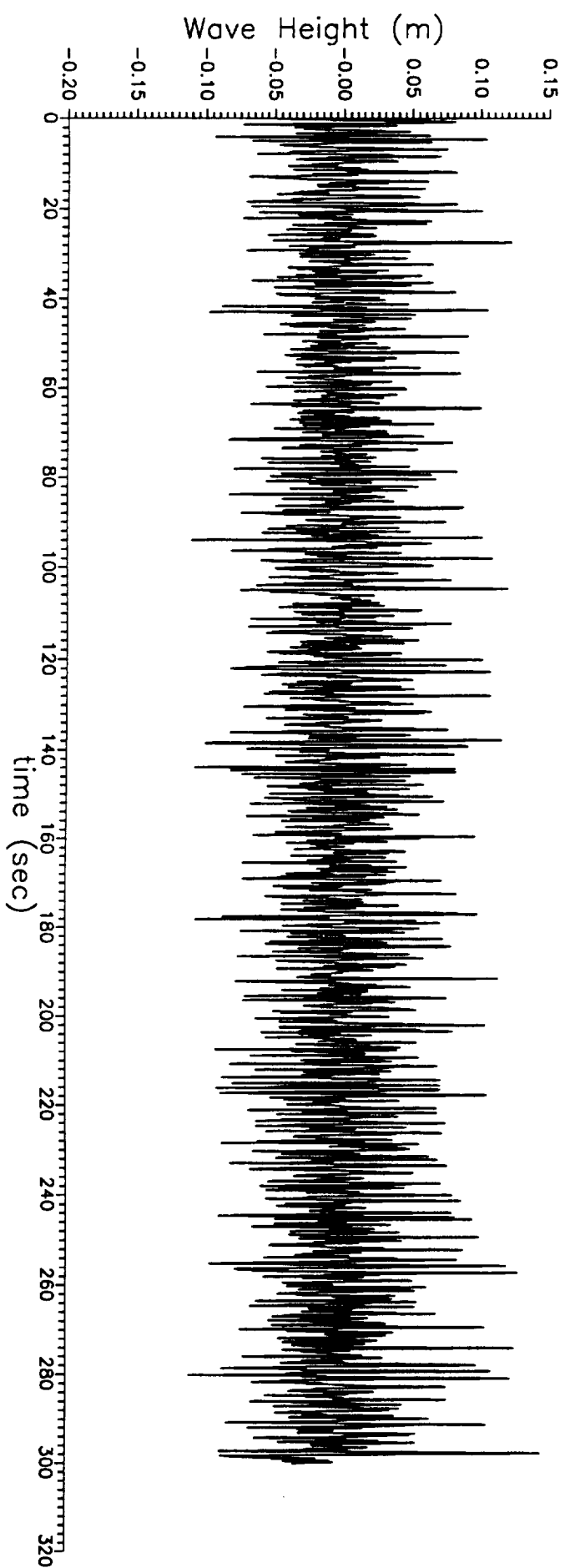
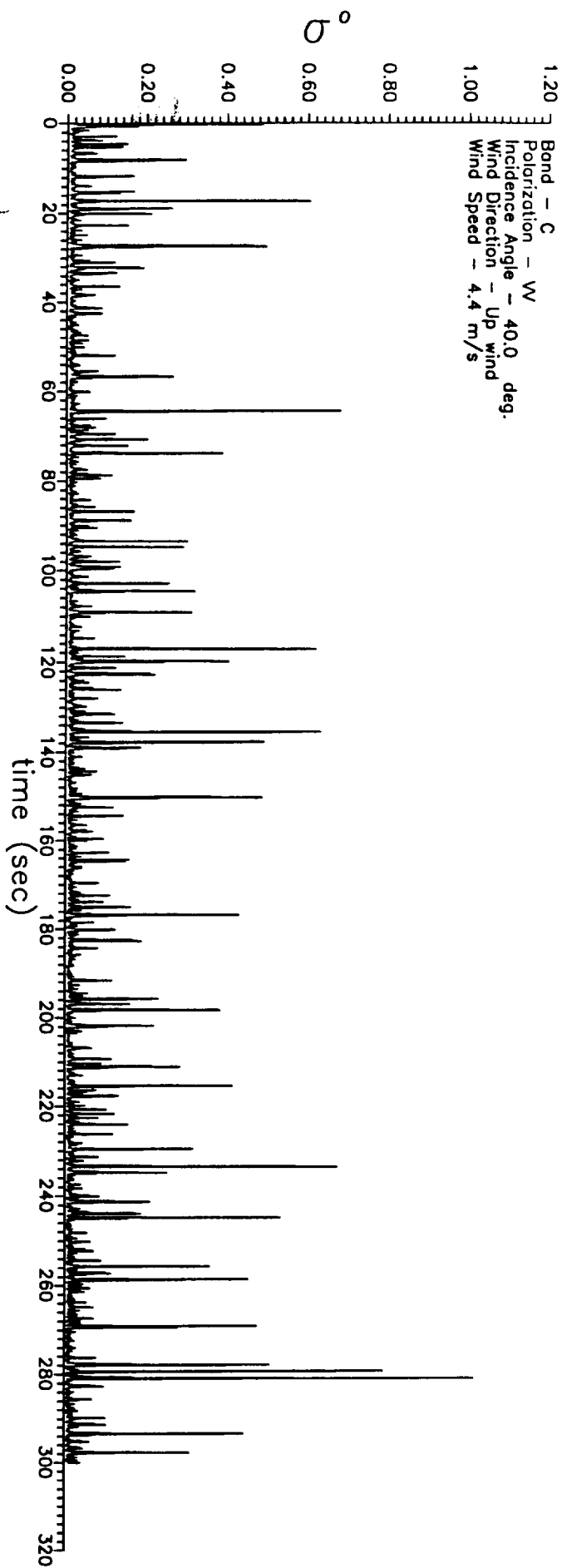


Run 16, 14:19, July 25, 1990

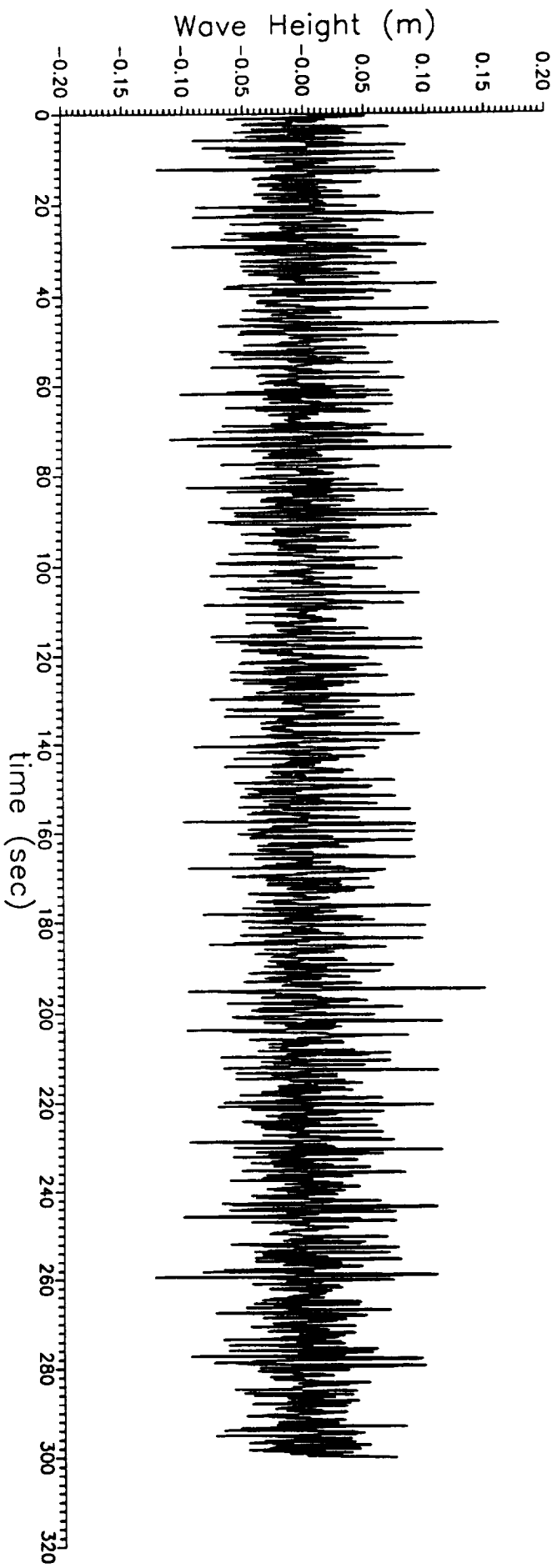
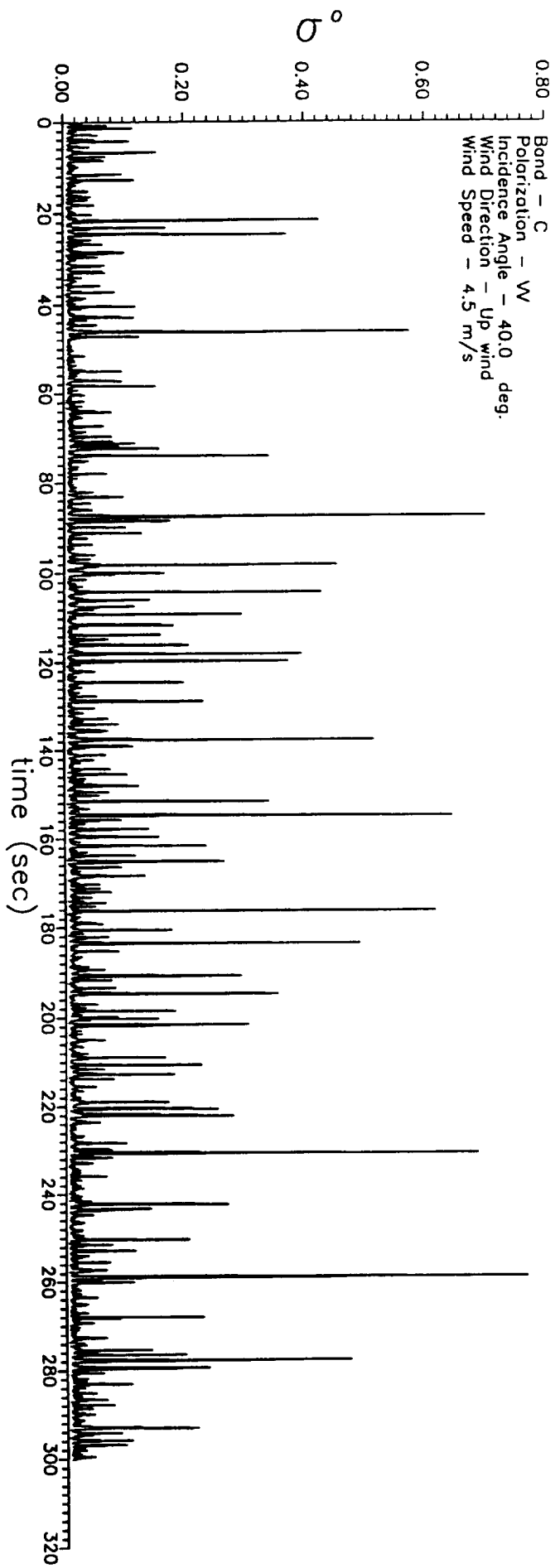


Run 12, 18:34, Aug 7, 1990

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s

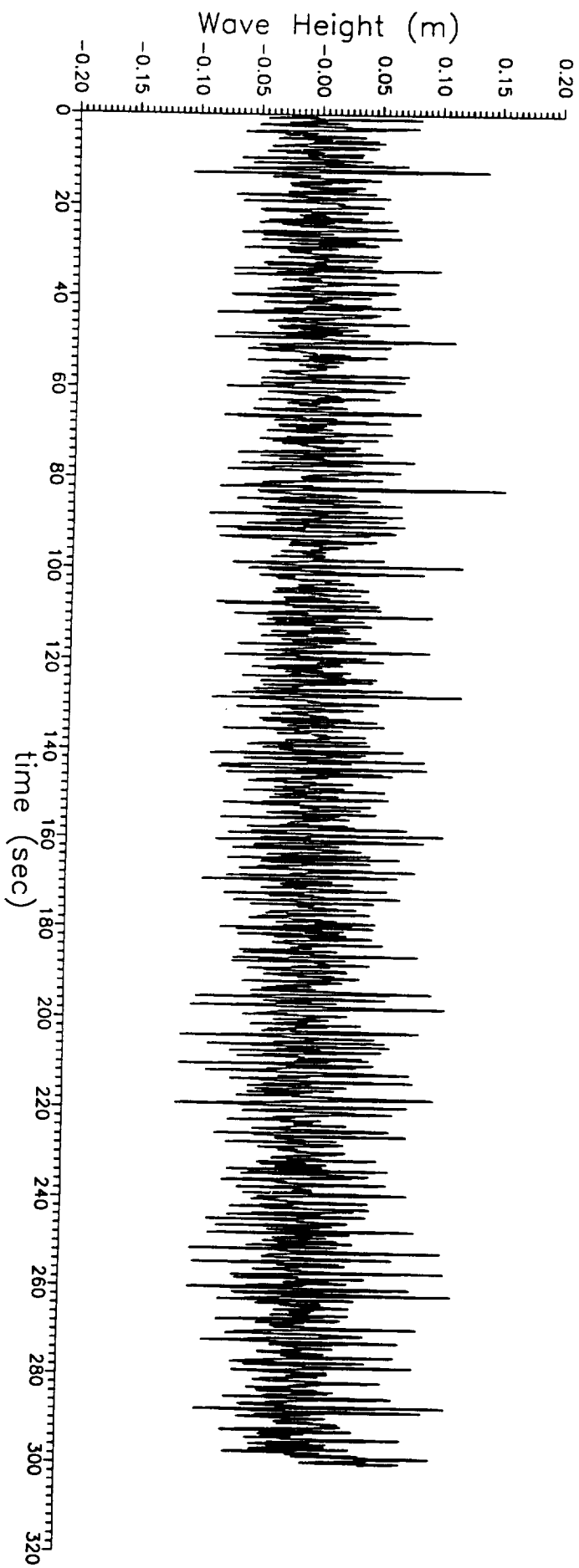
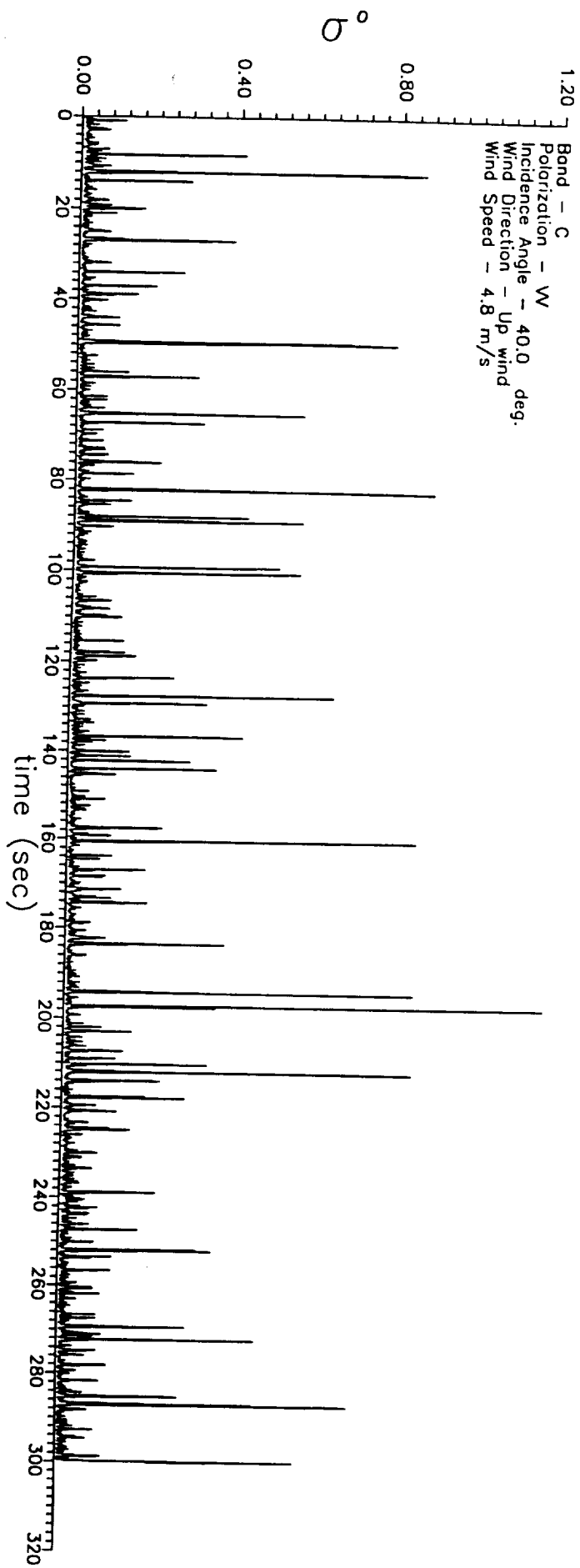


Run 13, 18:39, Aug 7, 1990



Run 14, 18:45, Aug 7, 1990

Band - C
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s

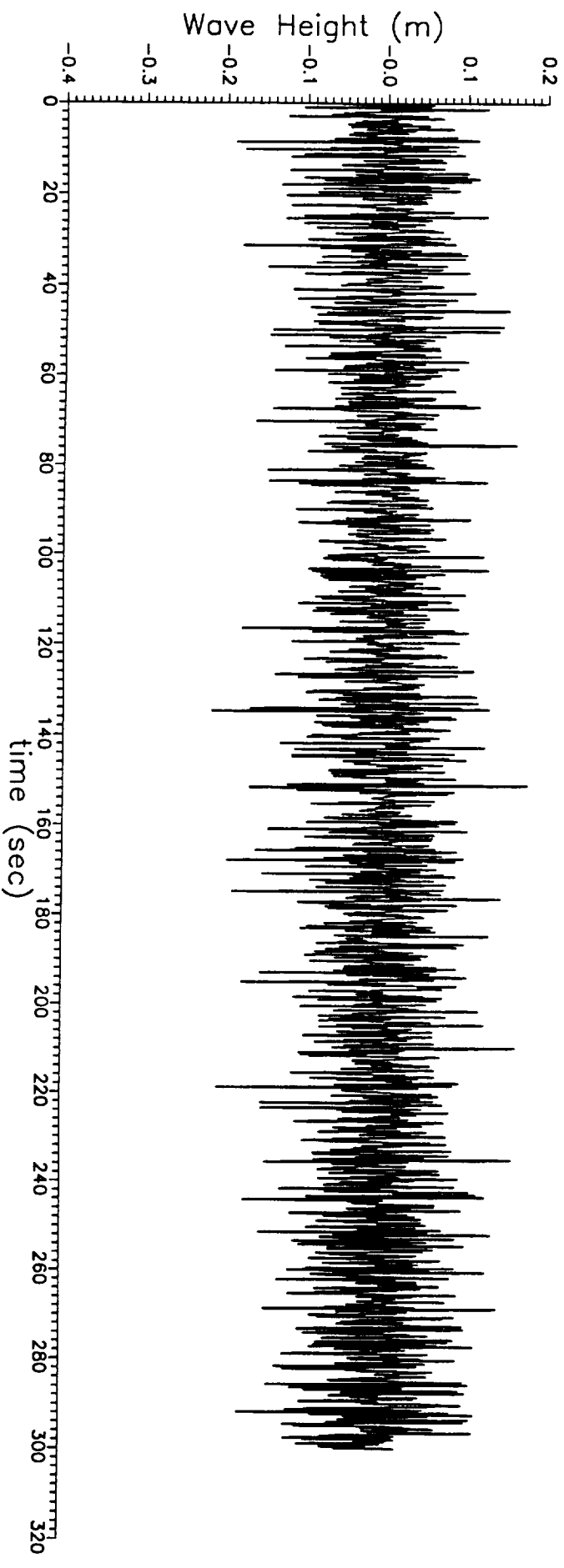
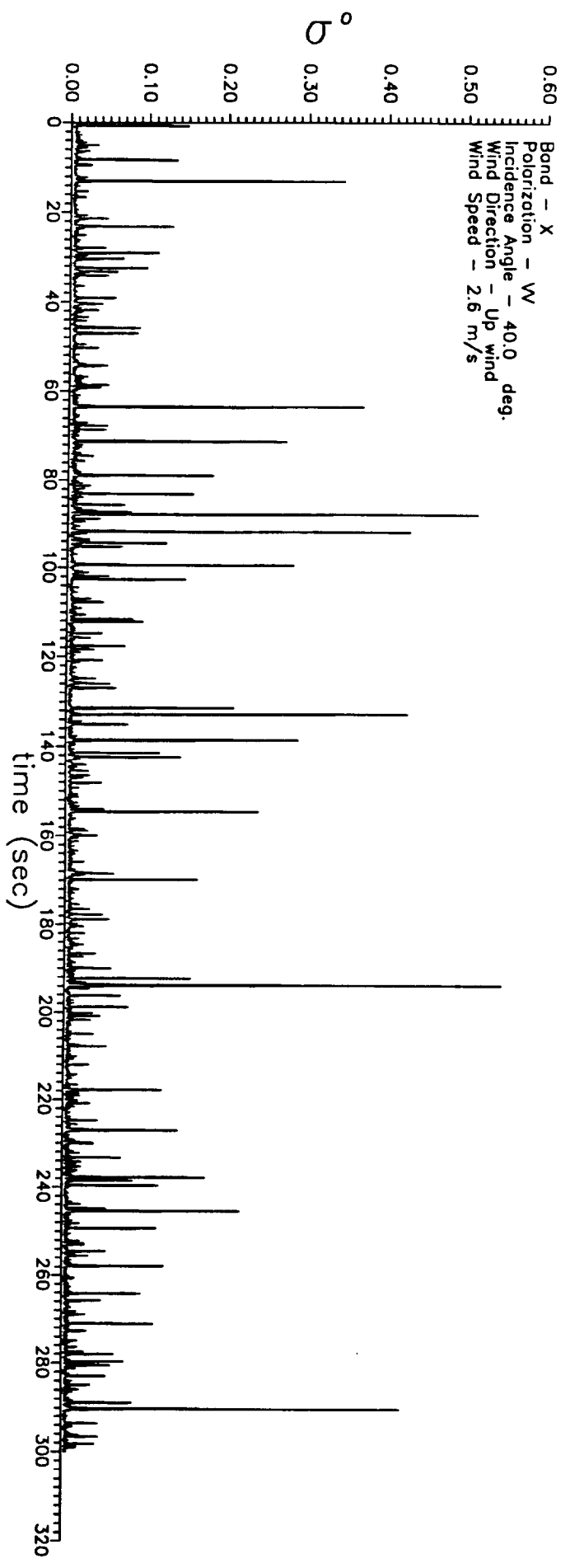




B-2. X Band

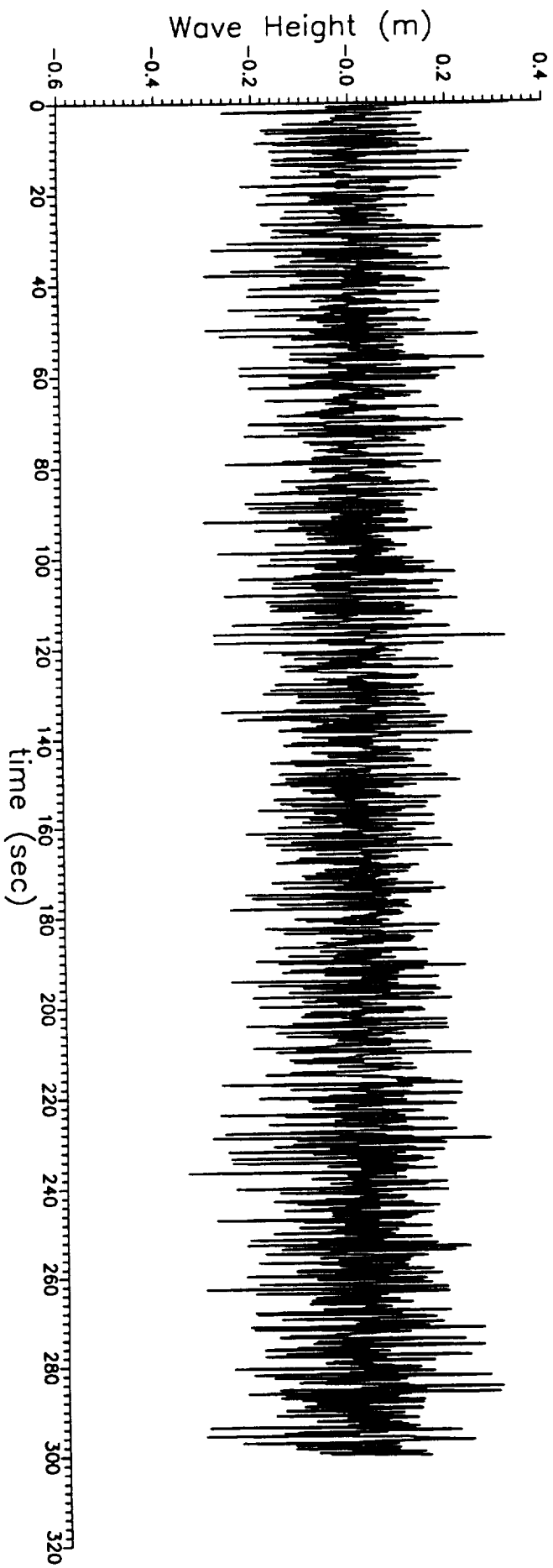
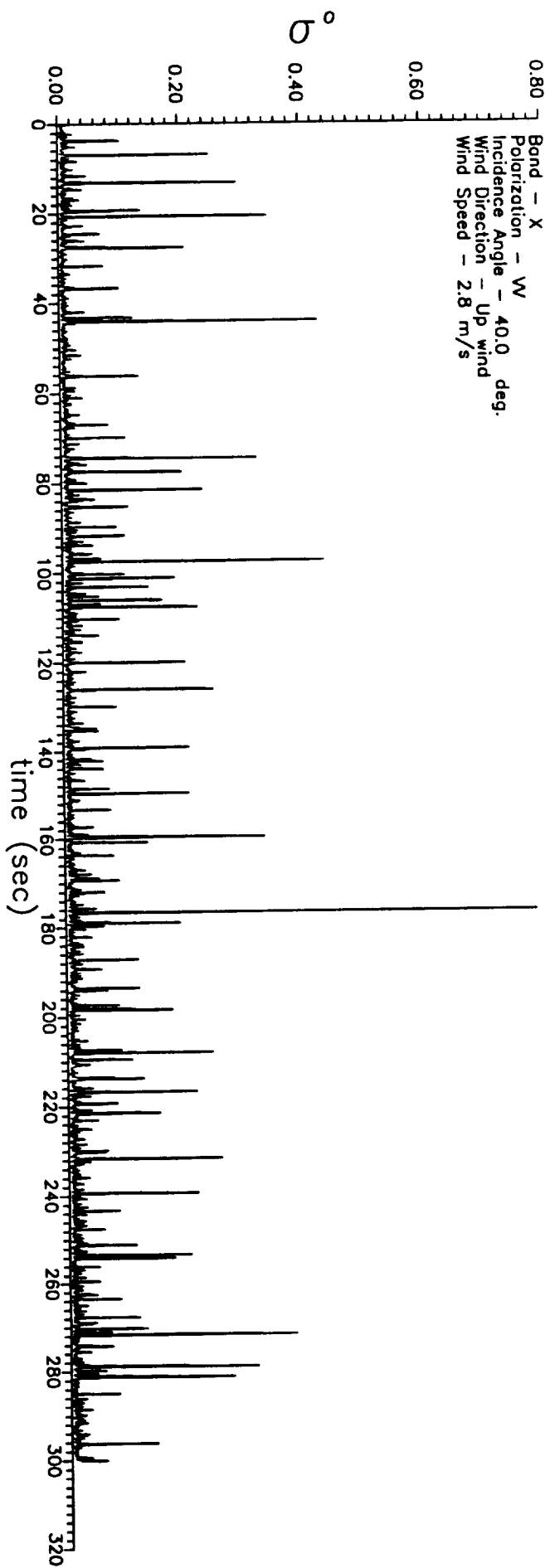


Run 26, 16:21, July 12, 1990



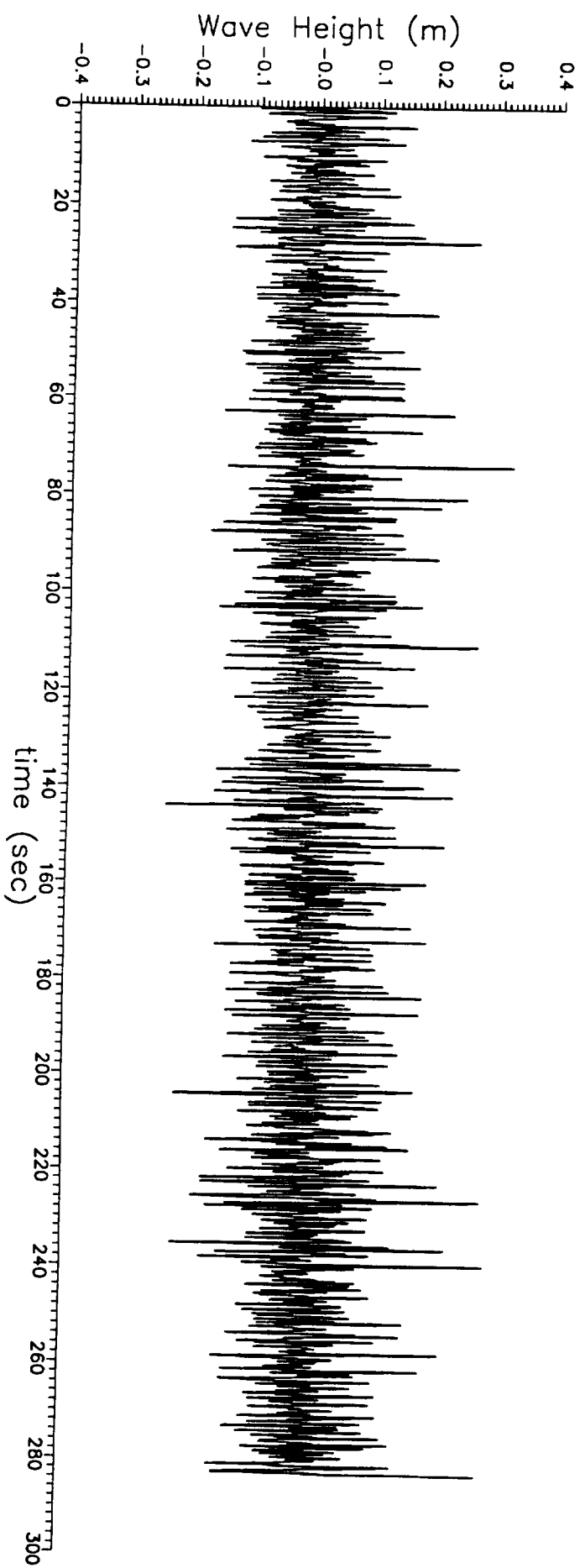
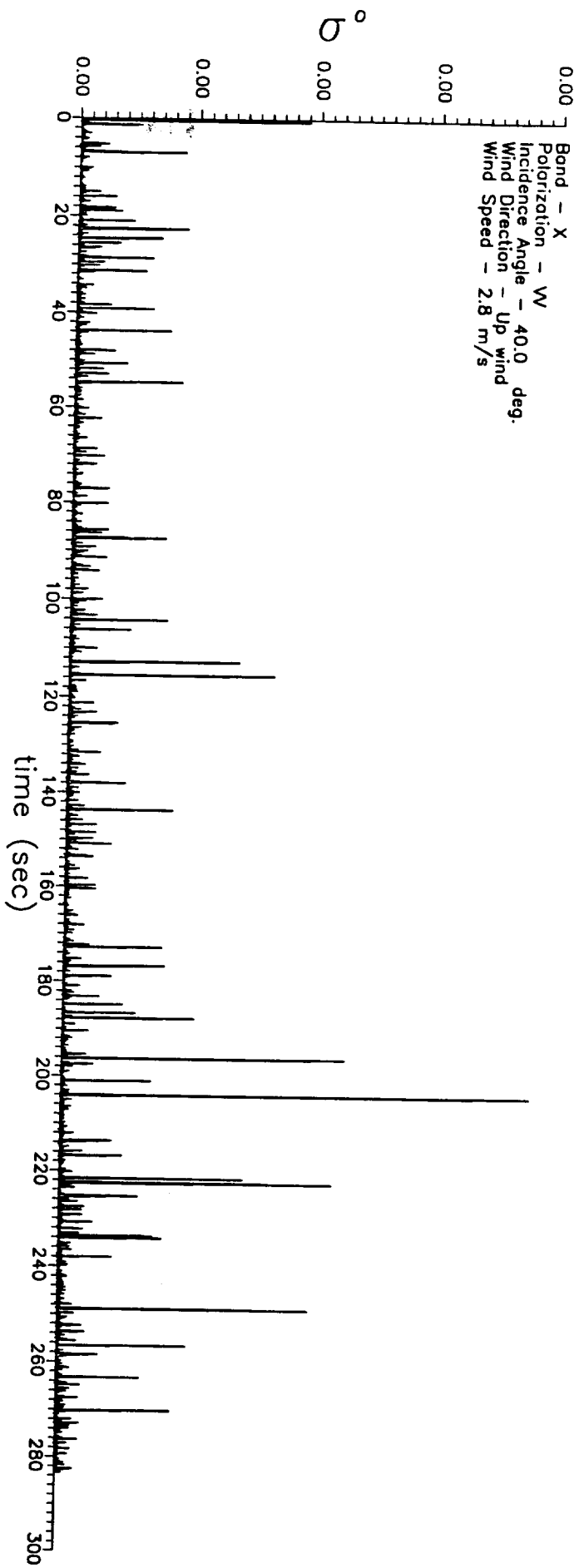
Run 28, 16:40, July 12, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 2.8 m/s



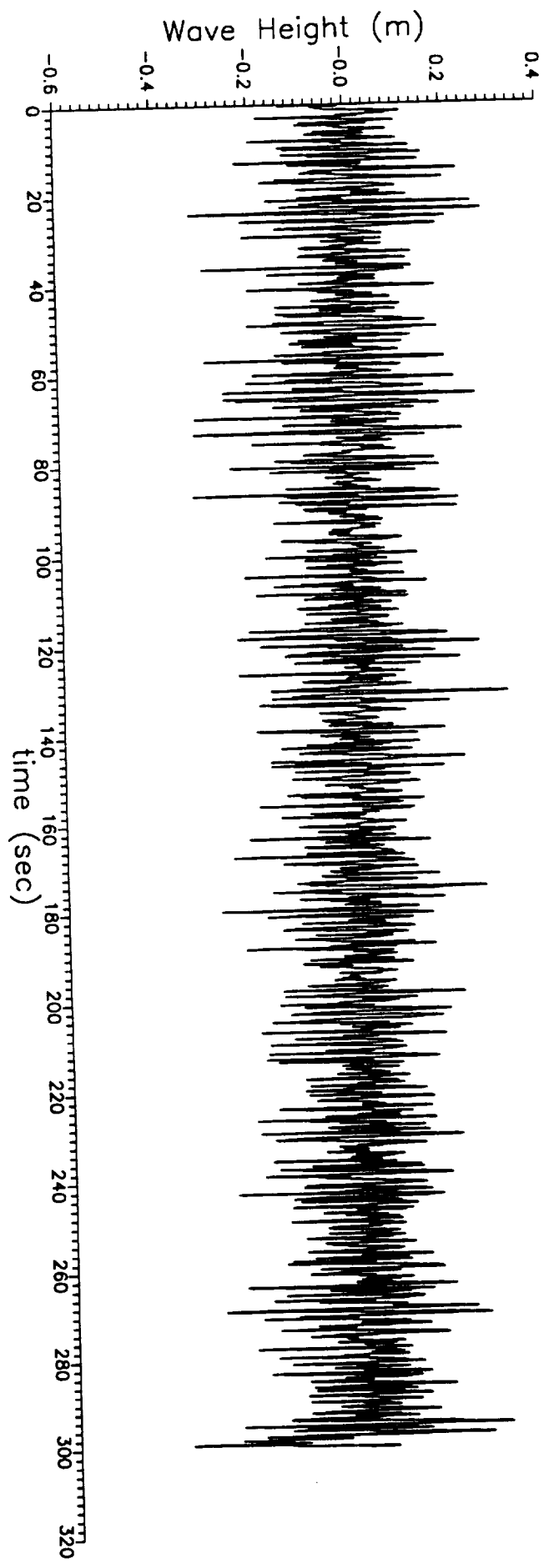
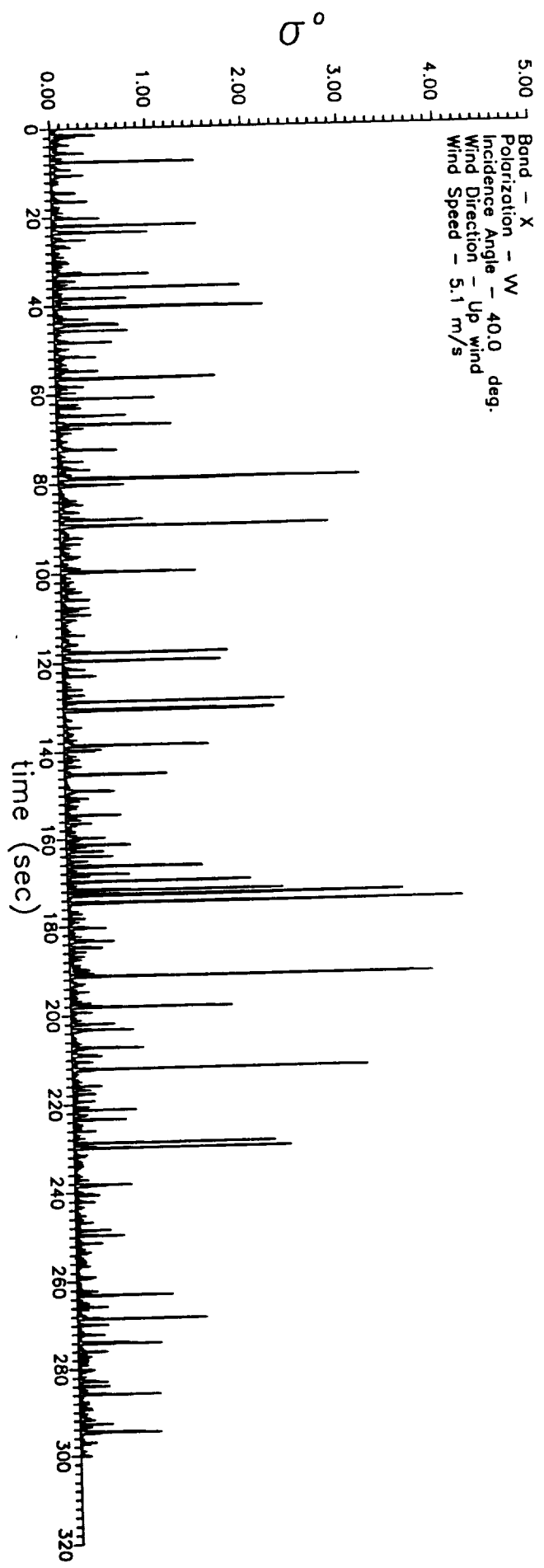
Run 21, 15:48, July 12, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 2.8 m/s



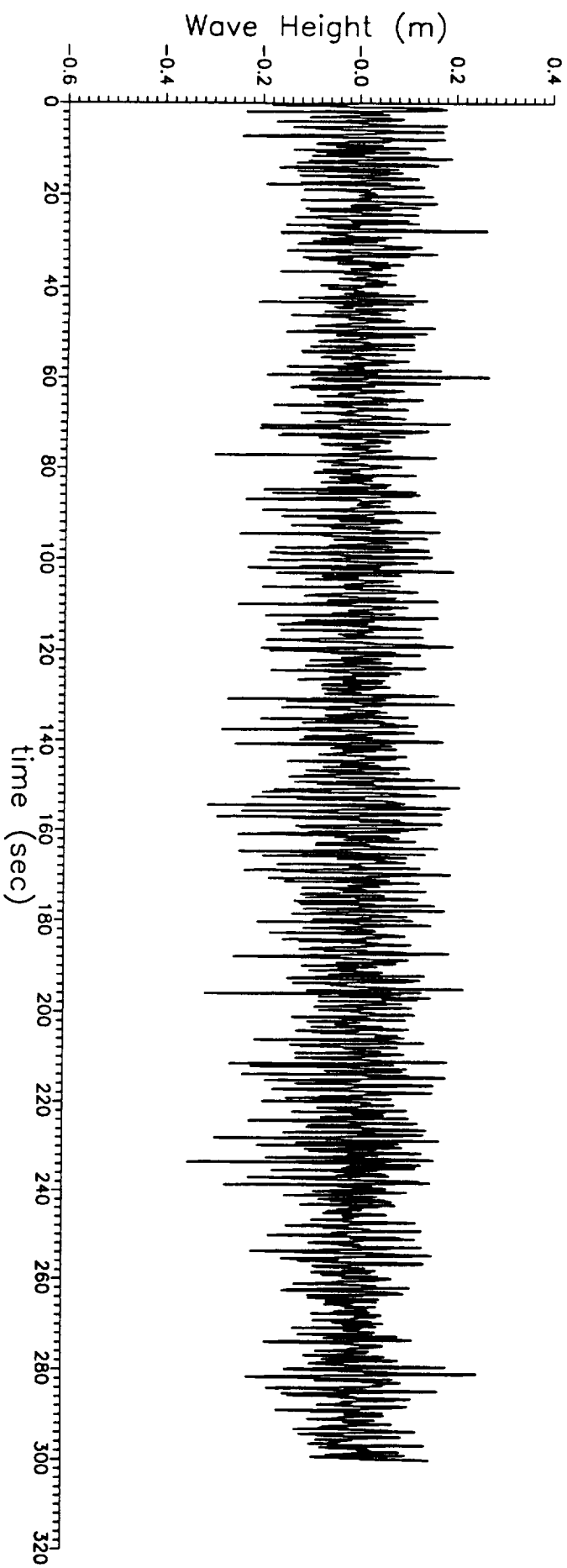
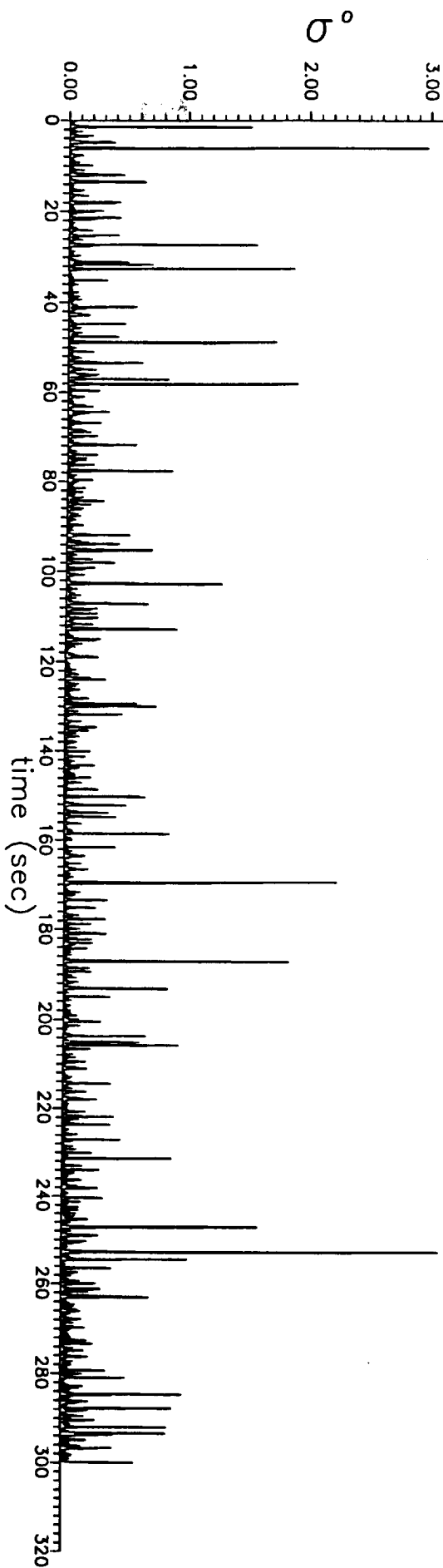
Run 25, 19:15, July 19, 1990

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.1 m/s

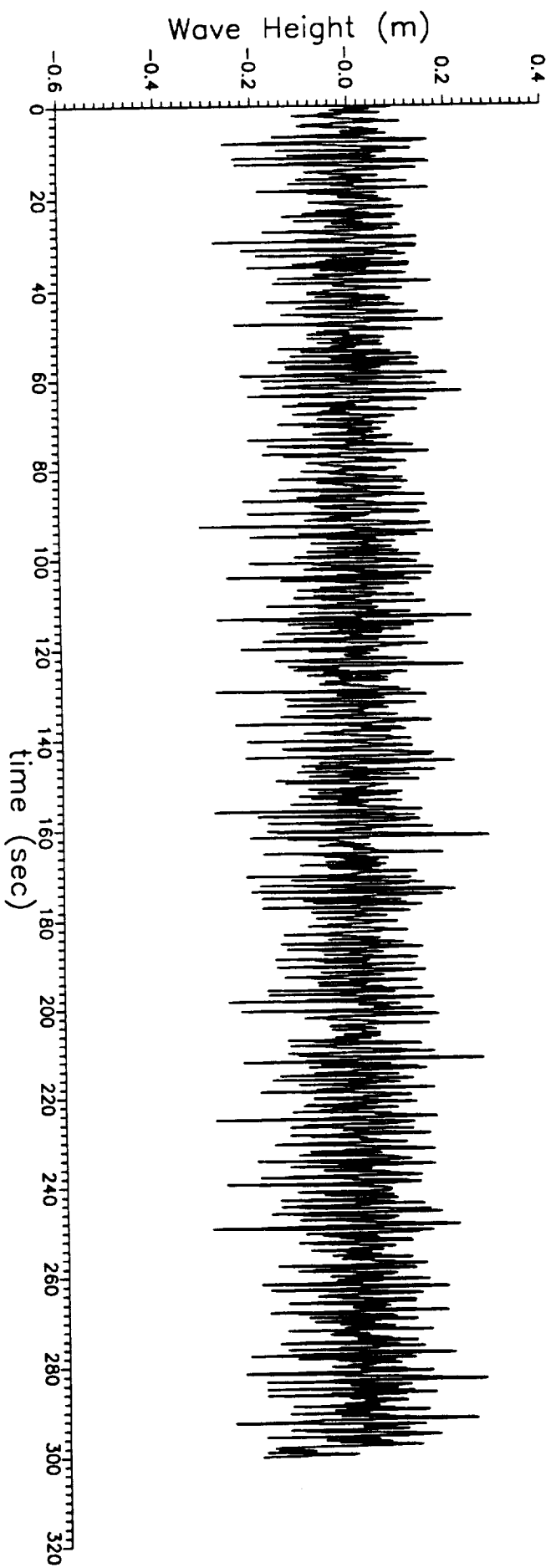
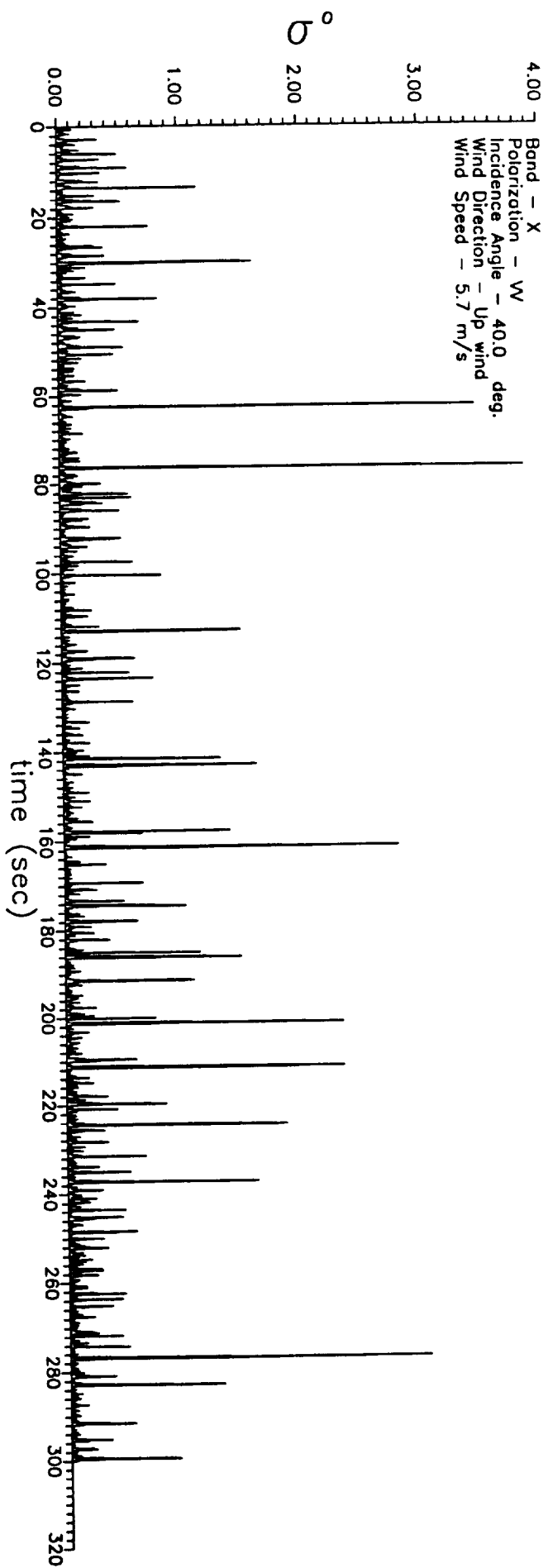


Run 15, 18:11, July 19, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 5.6 m/s

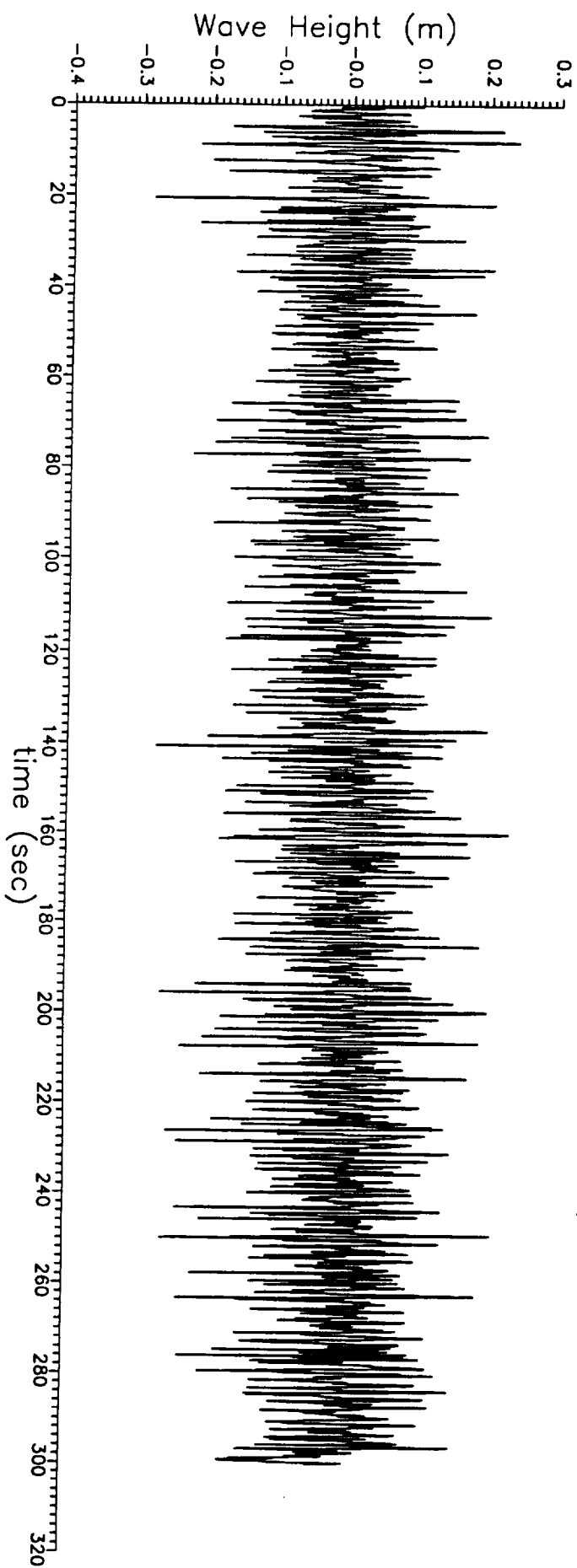
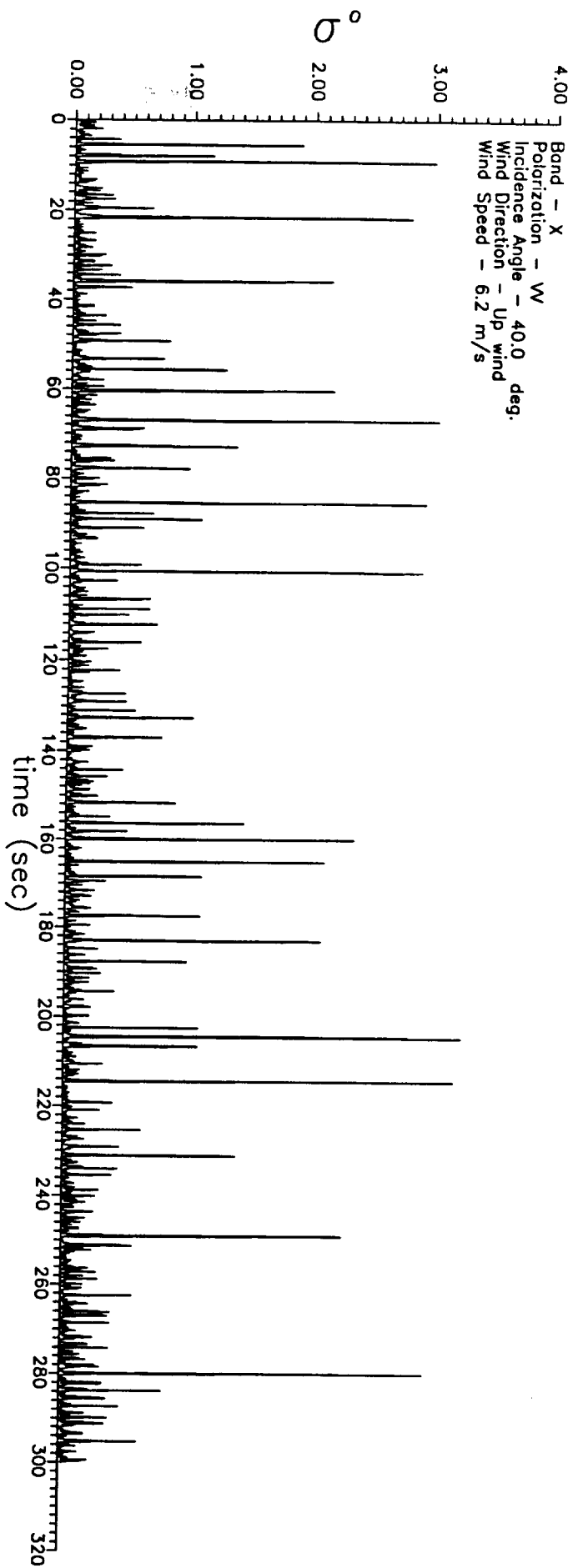


Run 26, 19:11, July 19, 1990

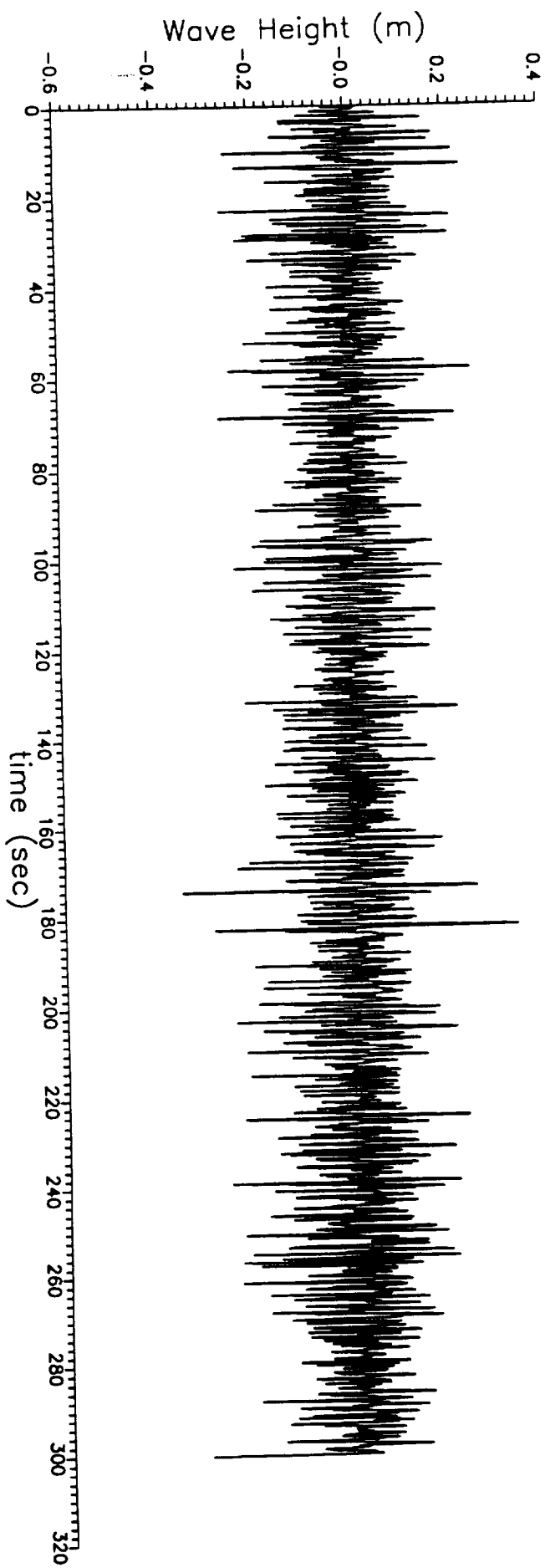
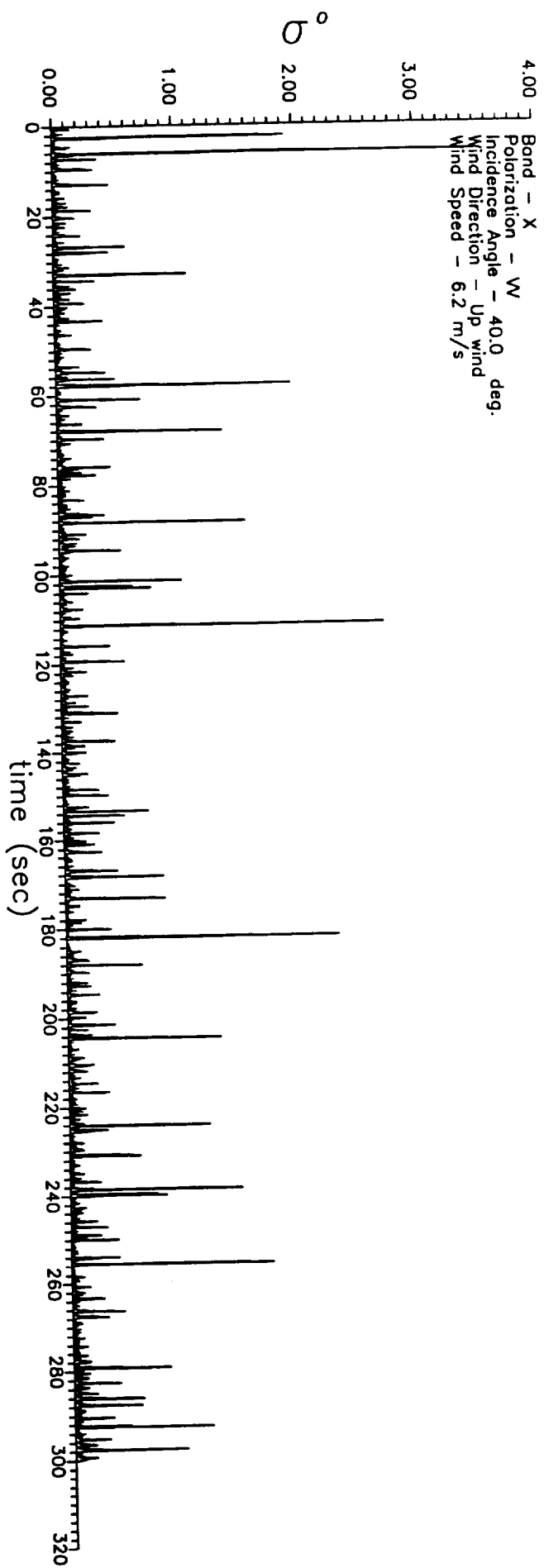


Run 19, 18:33, July 19, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.2 m/s

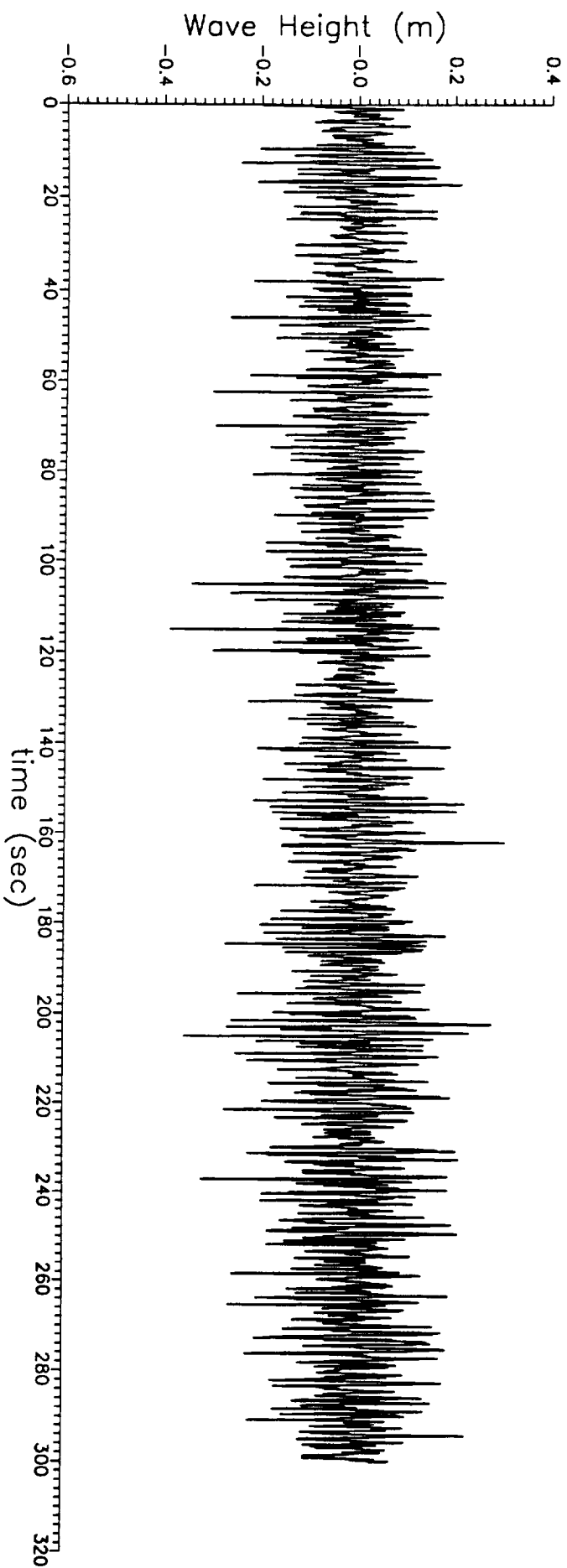
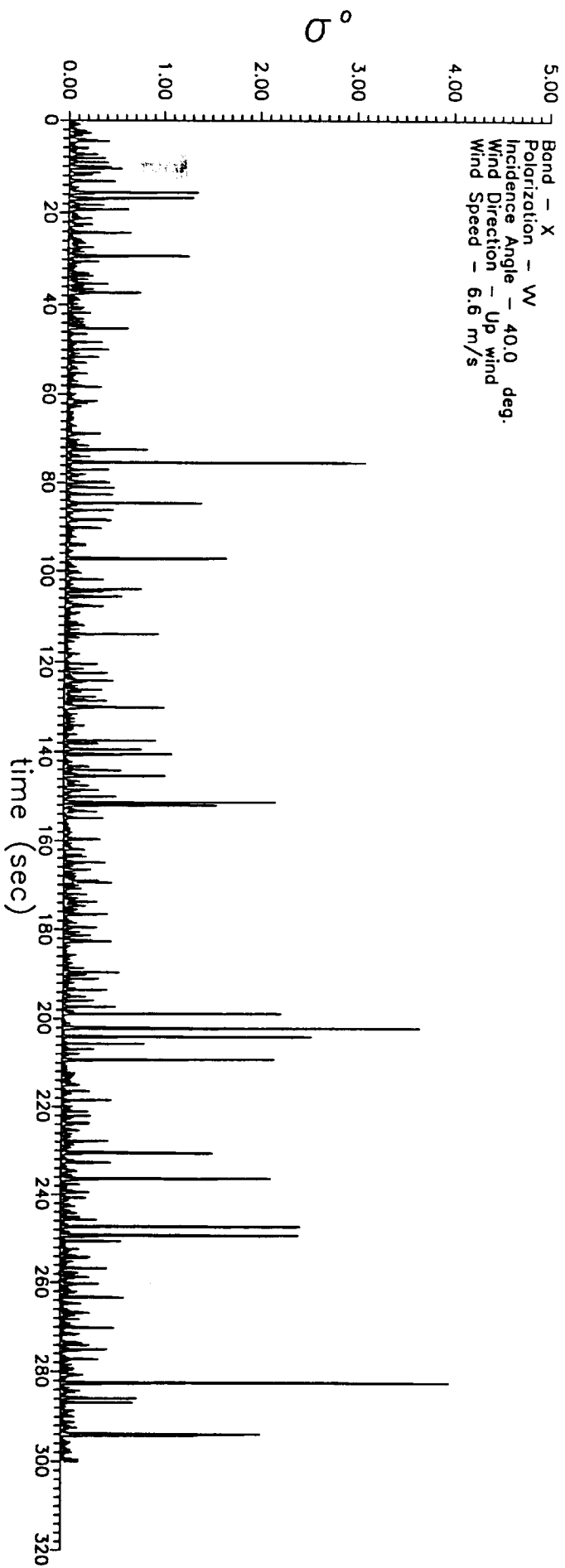


Run 9, 17:25, July 19, 1990



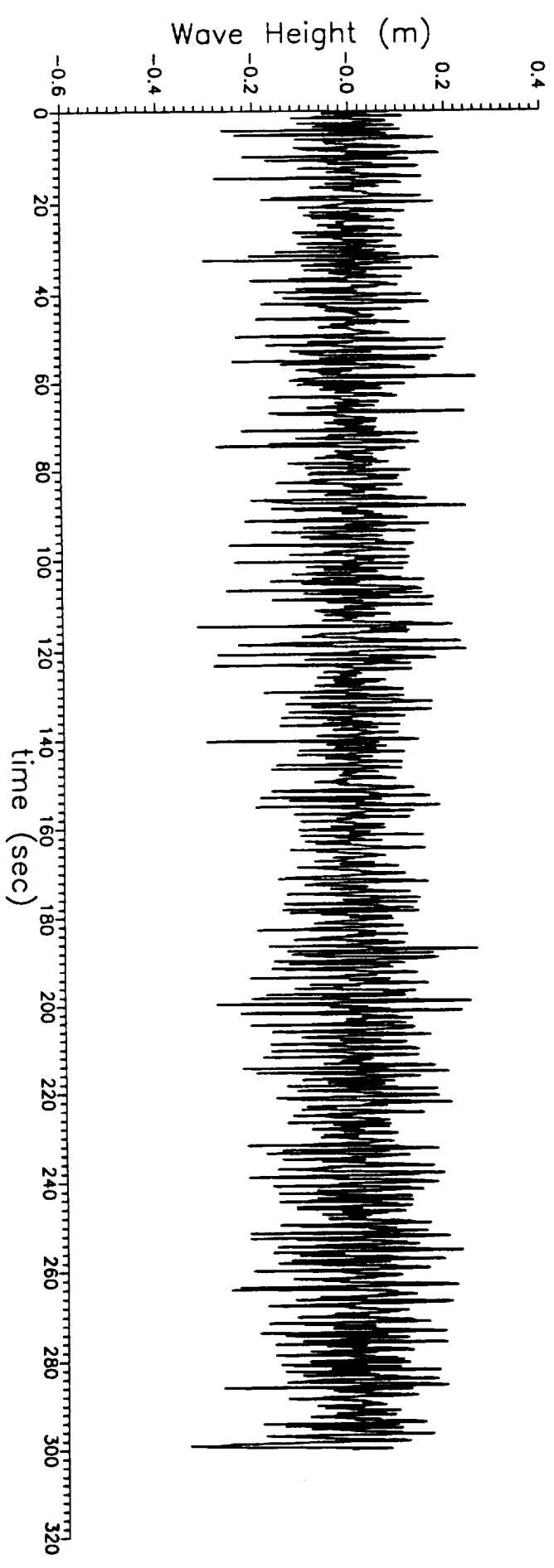
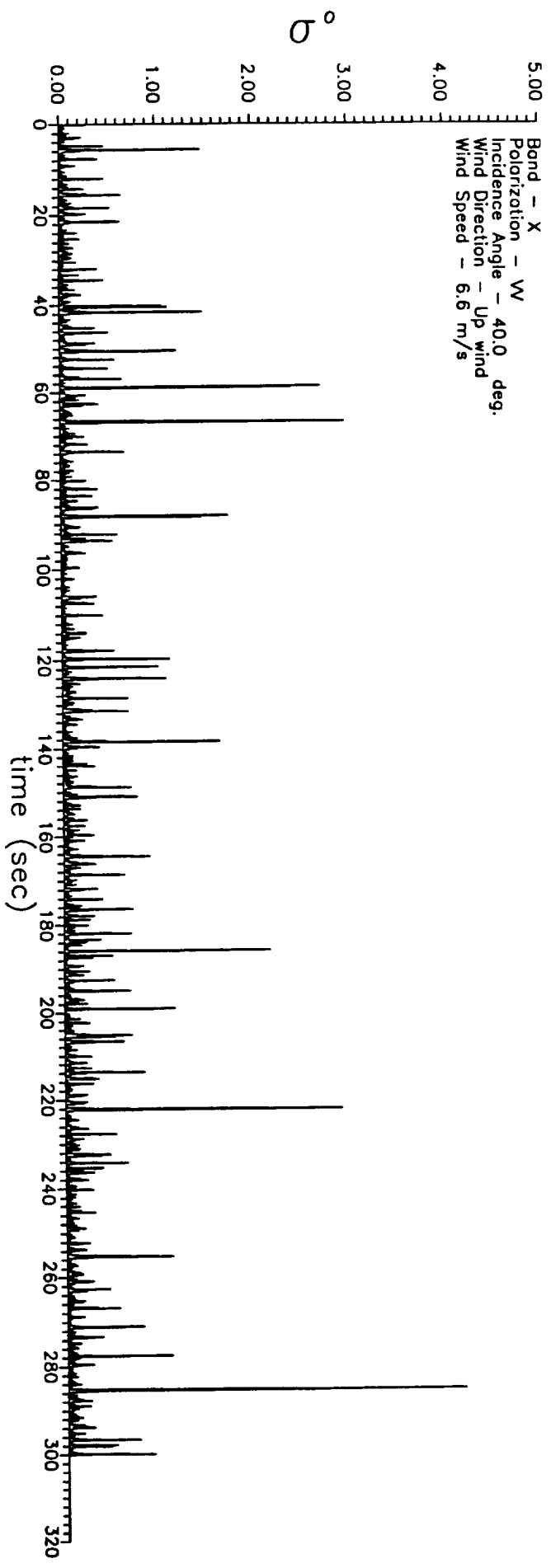
Run 22, 18:49, July 19, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s

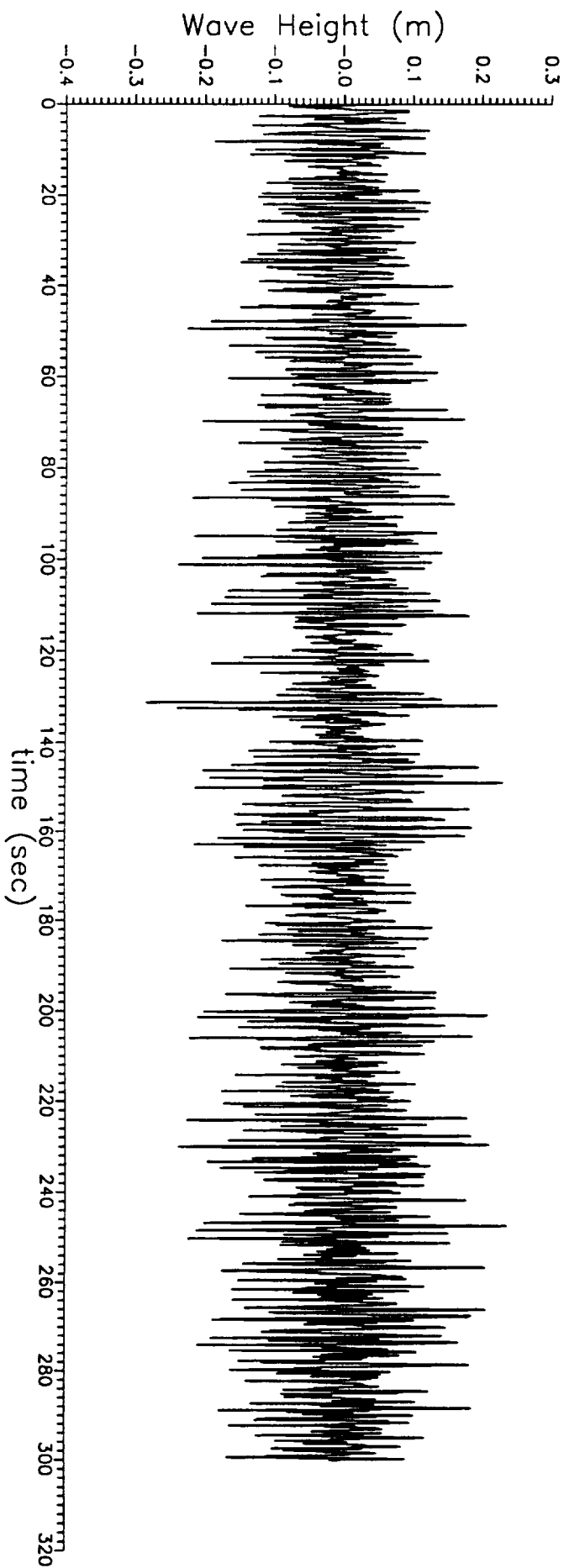
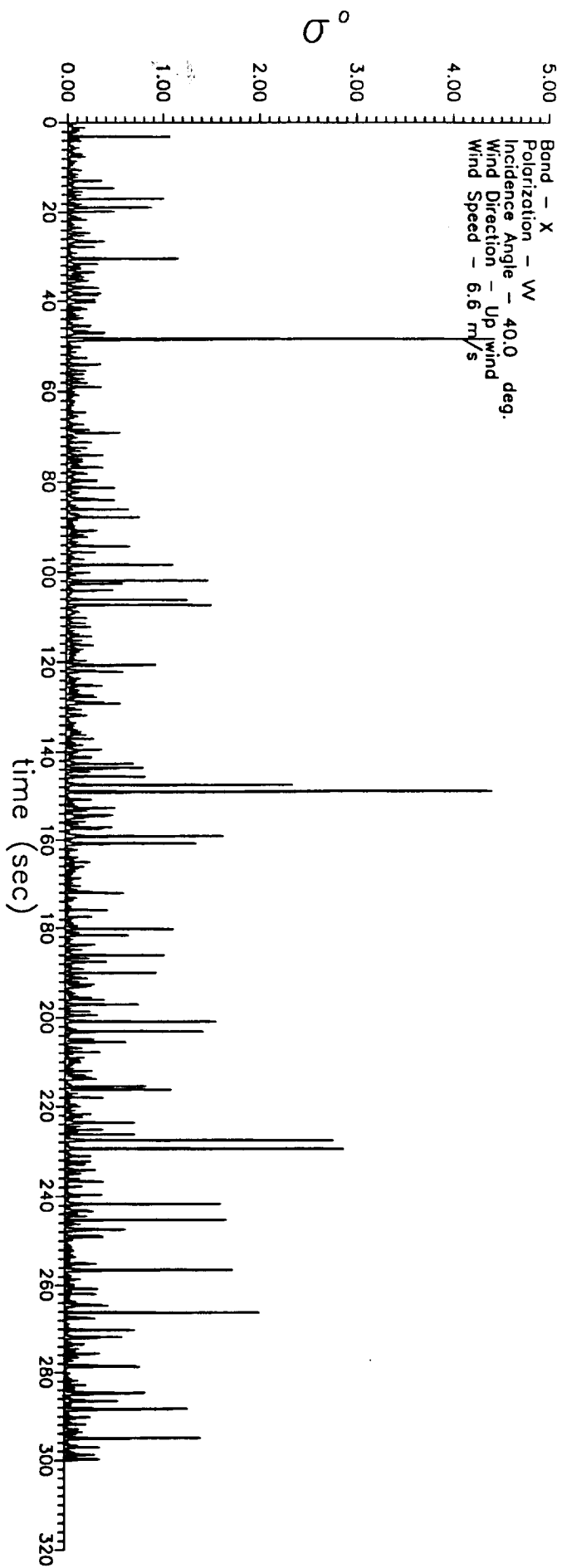


Run 24, 19:00, July 19, 1990

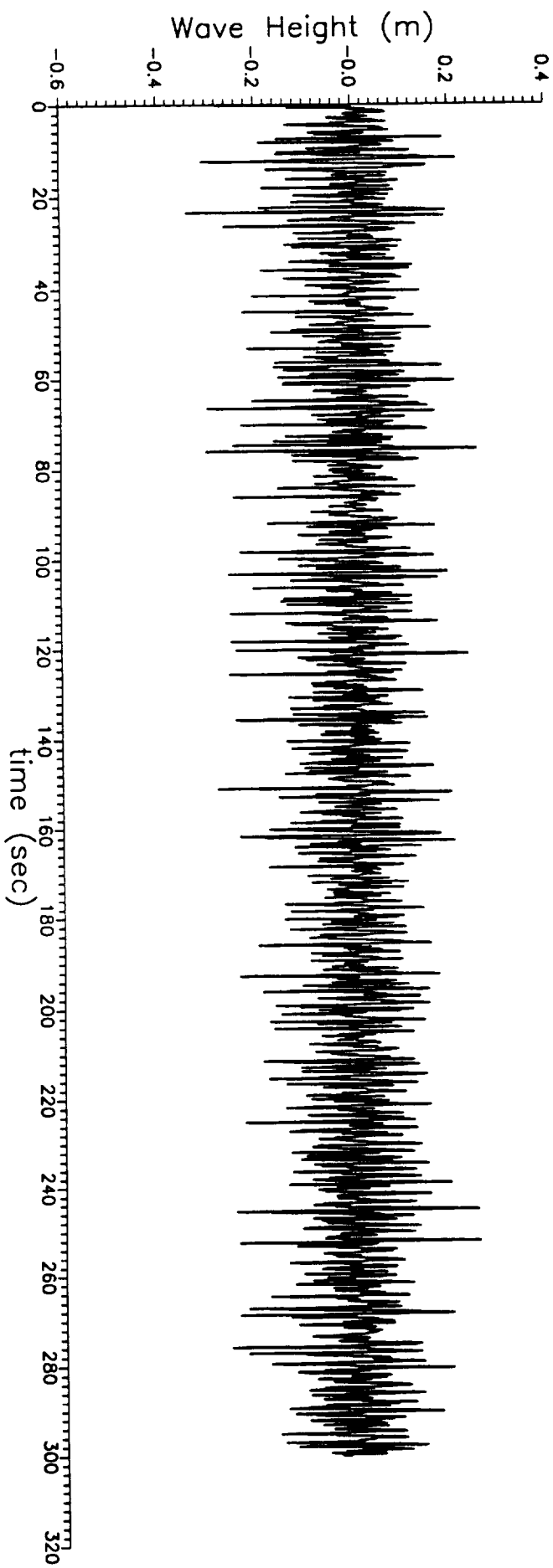
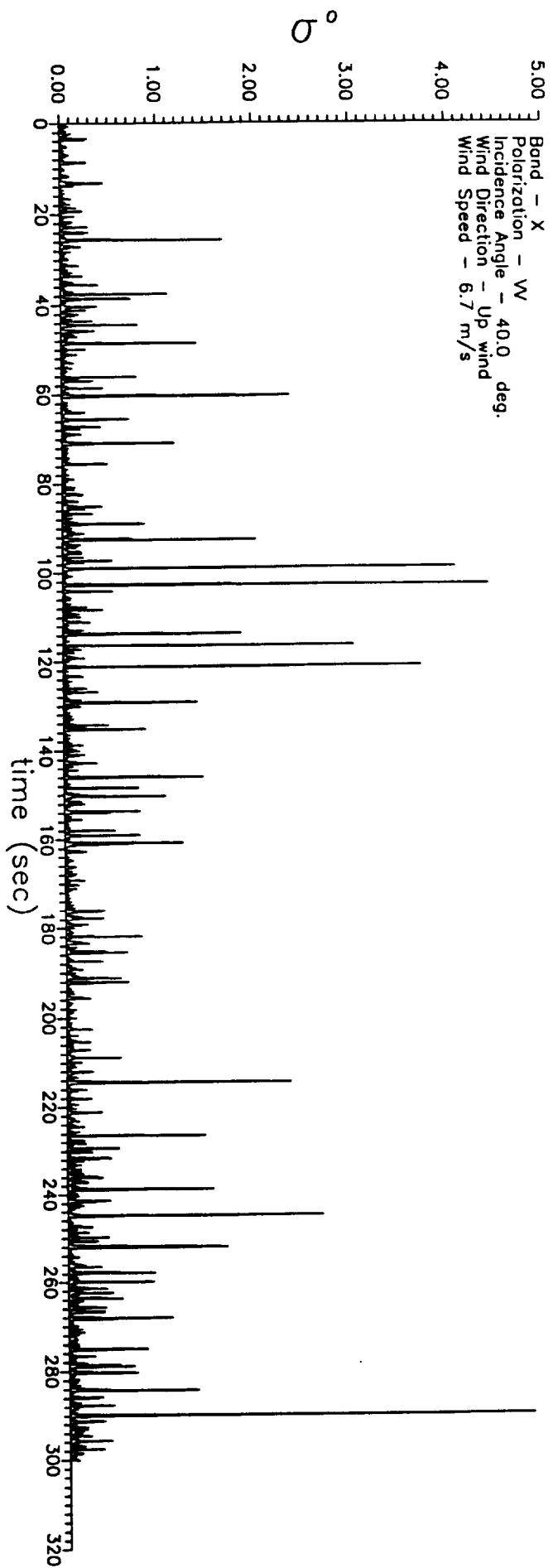
Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.6 m/s



Run 18, 18:28, July 19, 1990

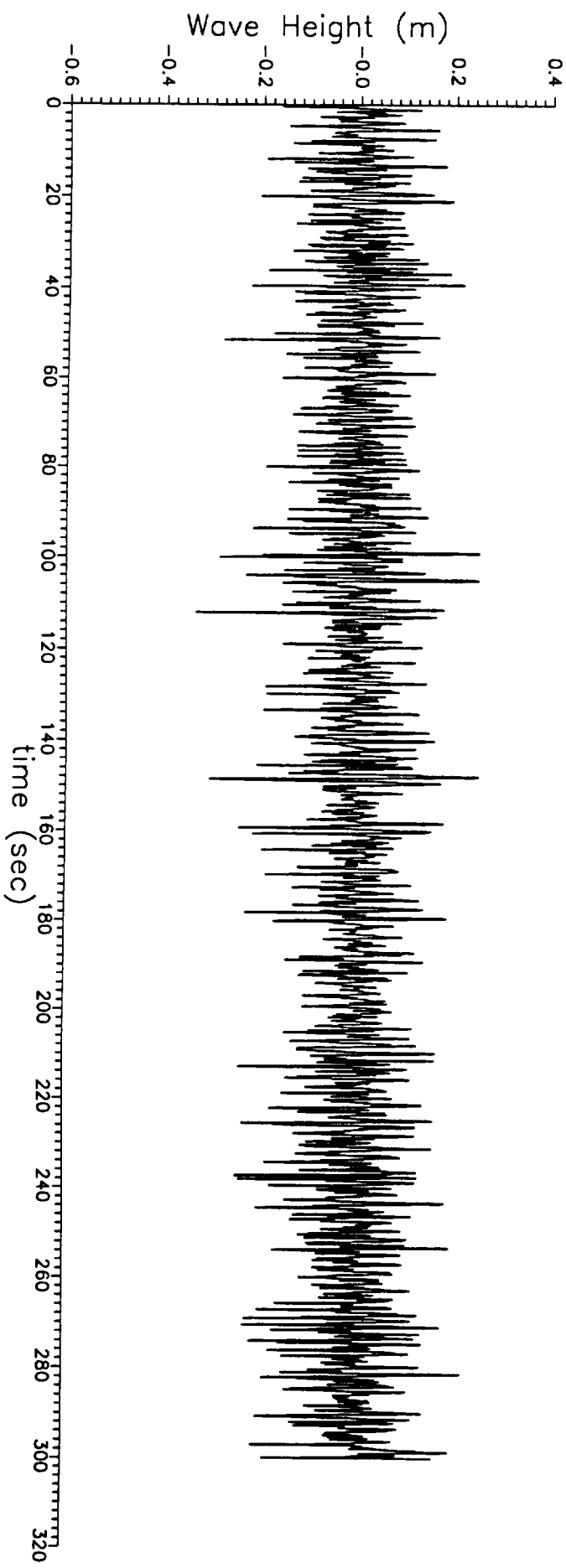
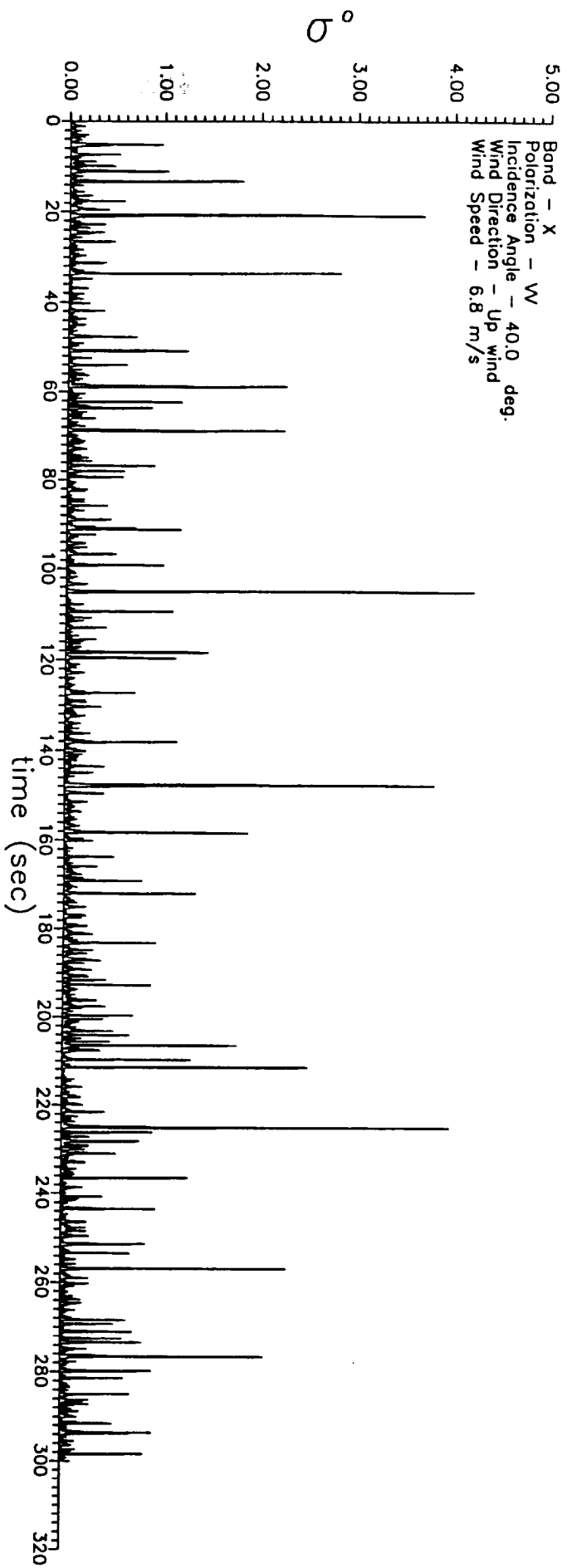


Run 17, 18:22, July 19, 1990



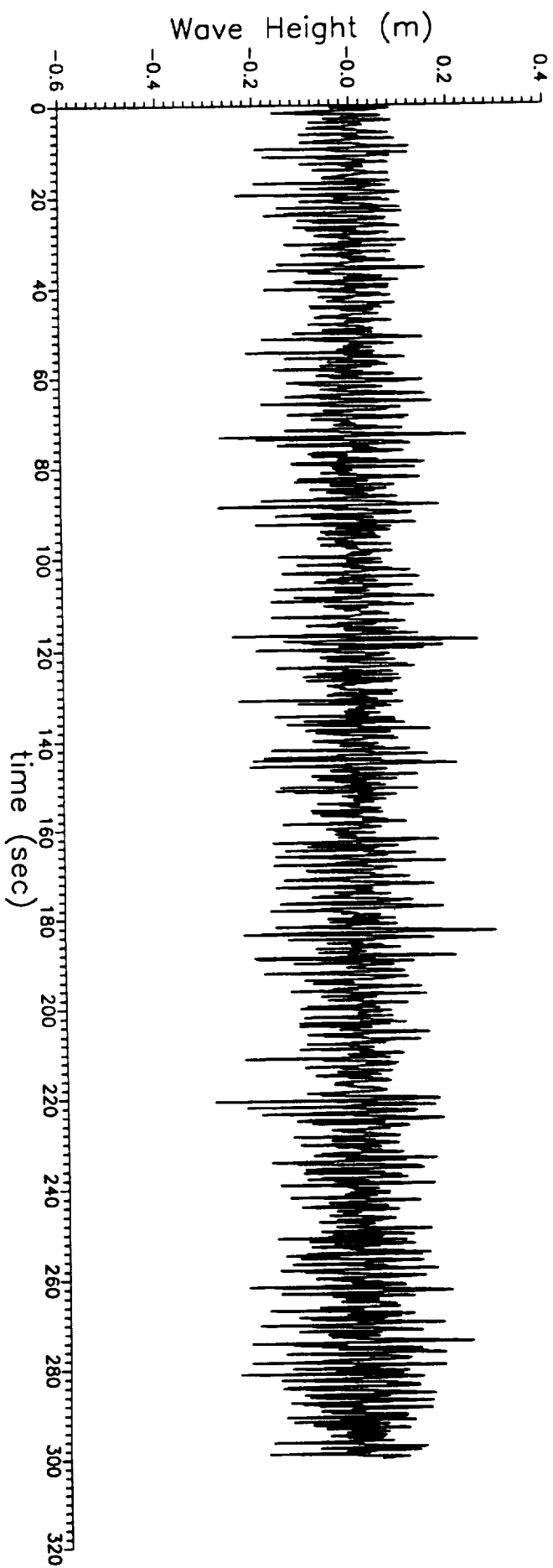
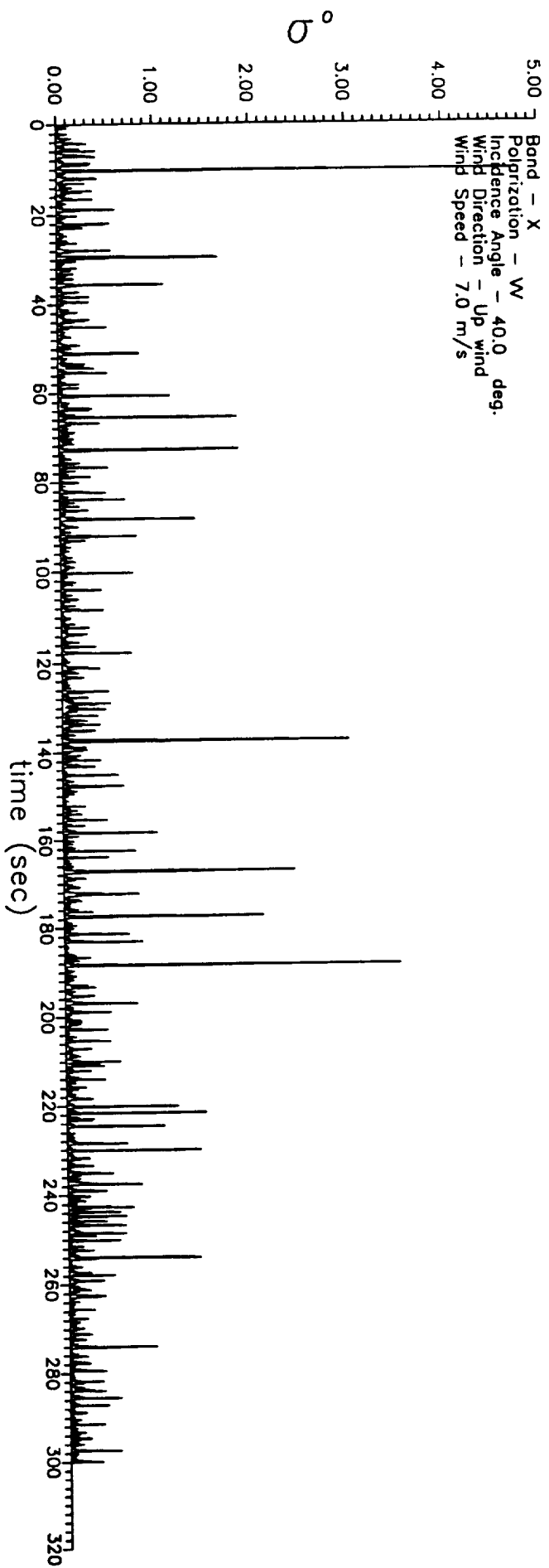
Run 20, 18:38, July 19, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 6.8 m/s

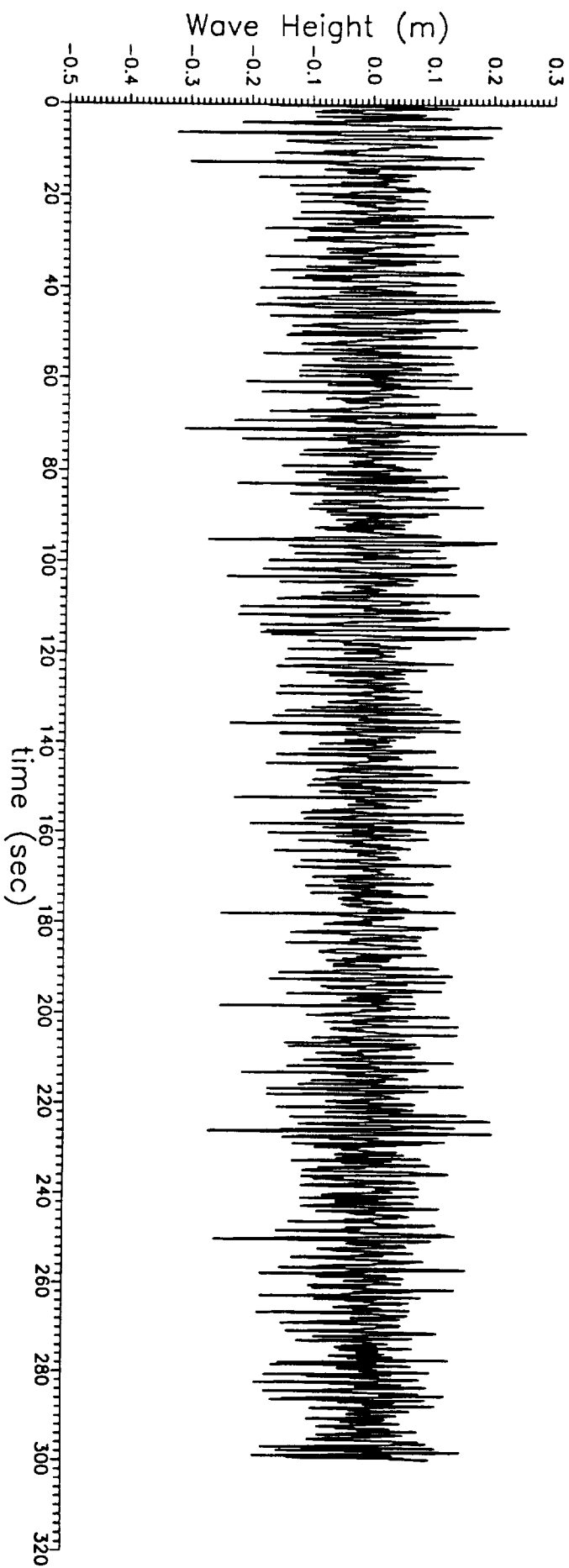
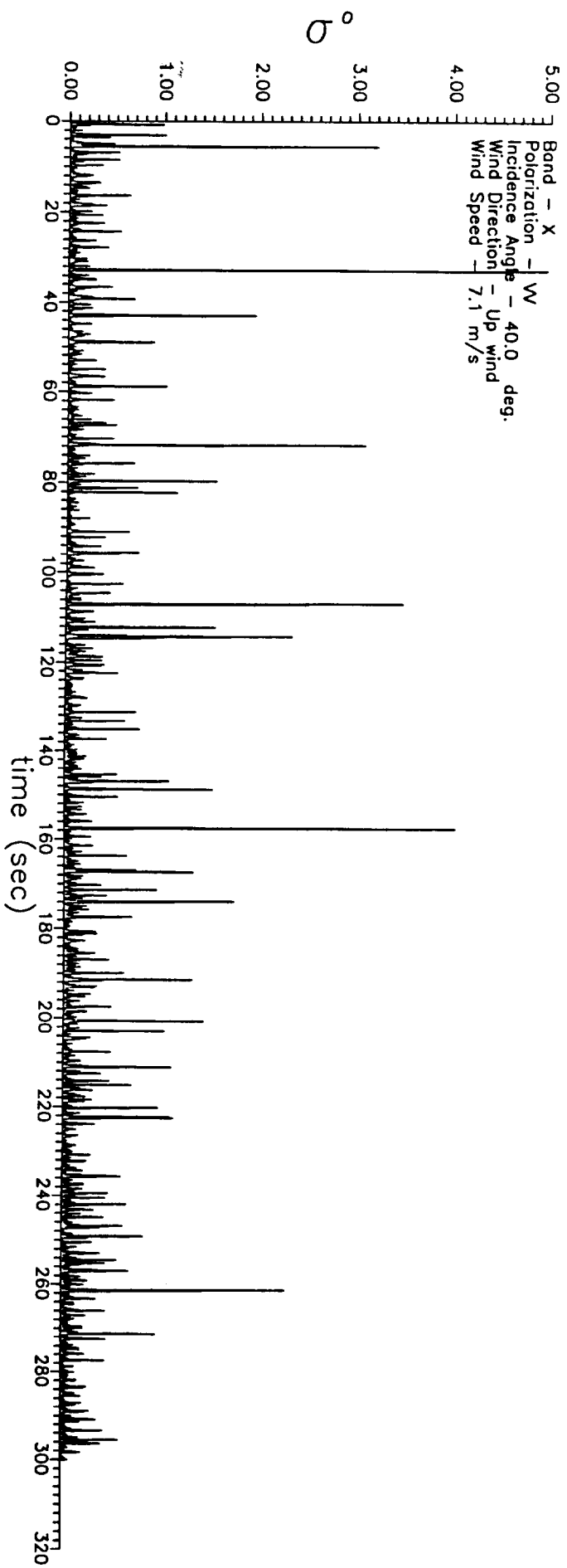


Run 16, 18:17, July 19, 1990

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.0 m/s

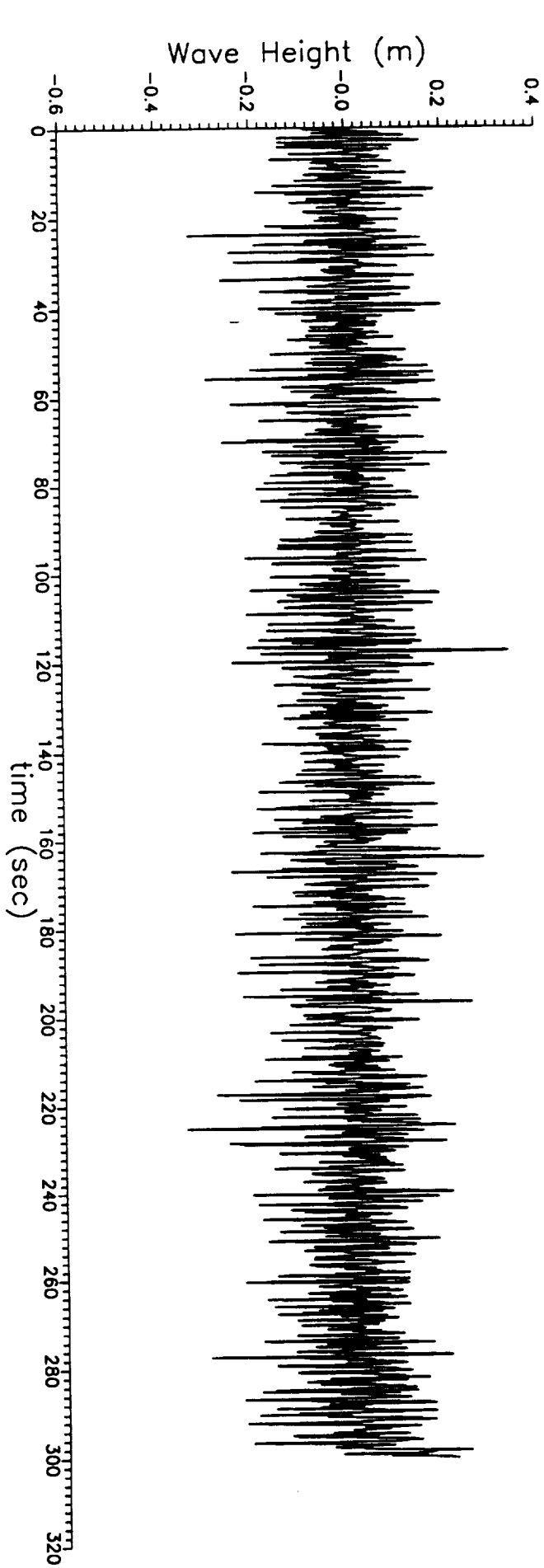
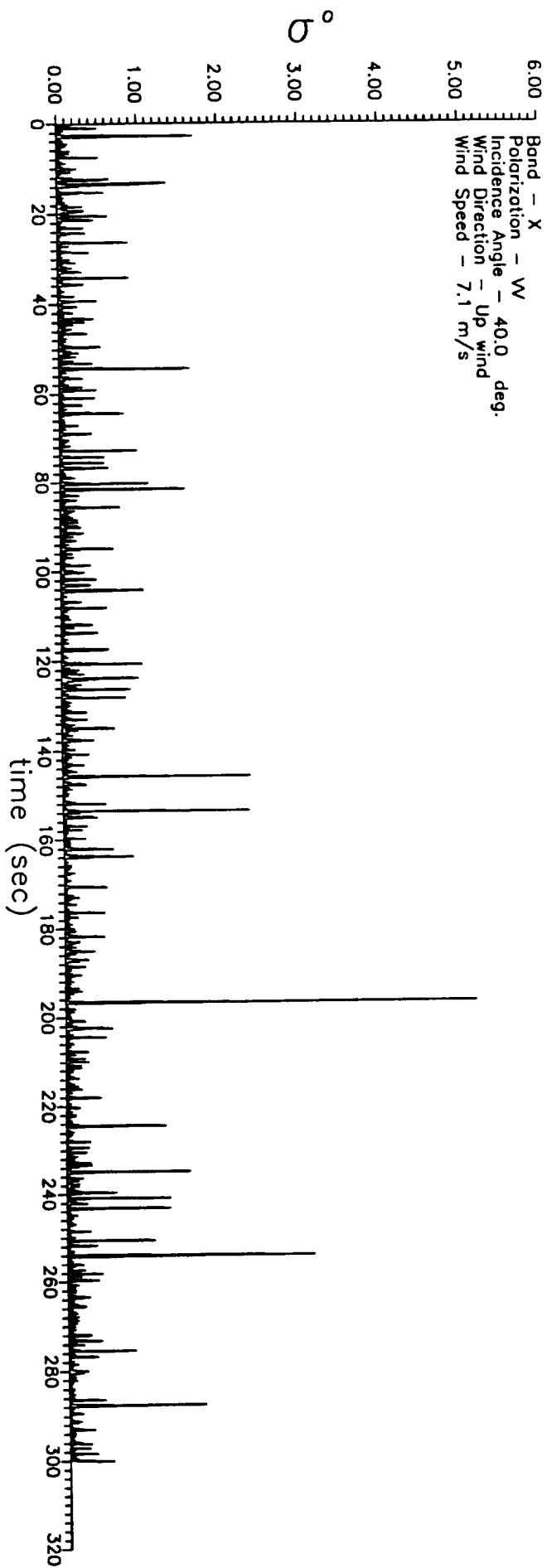


Run 21, 18:44, July 19, 1990



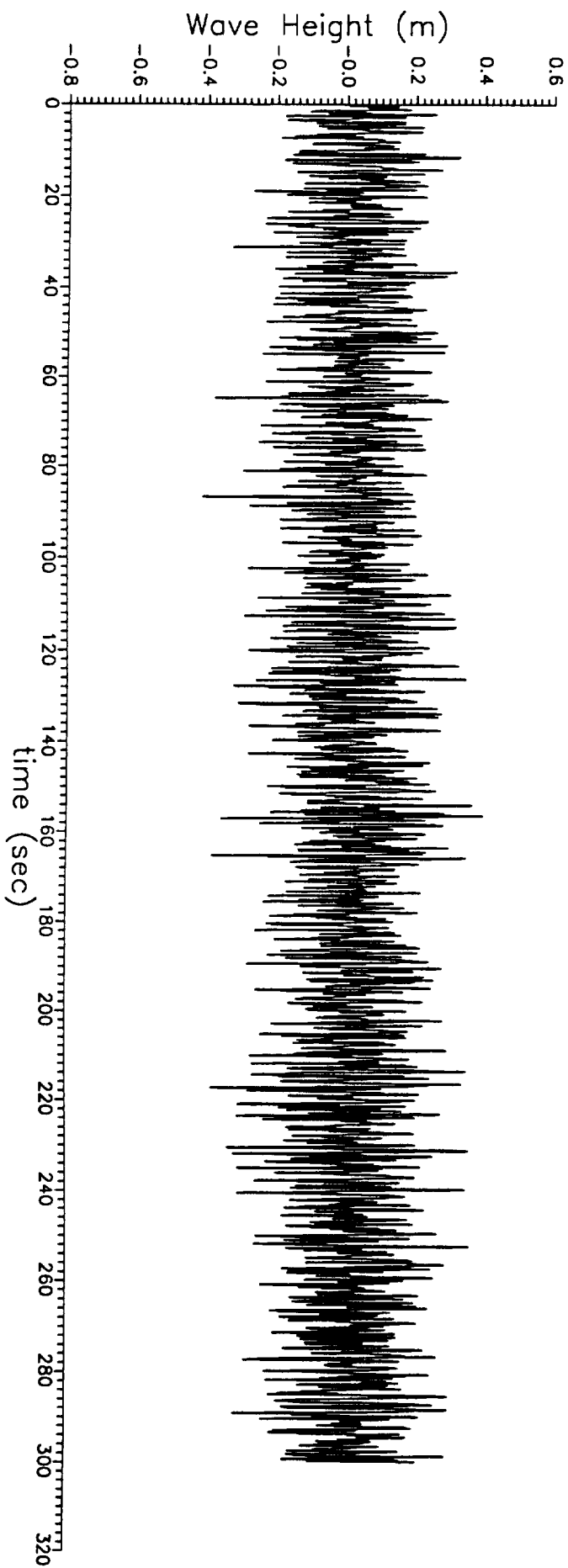
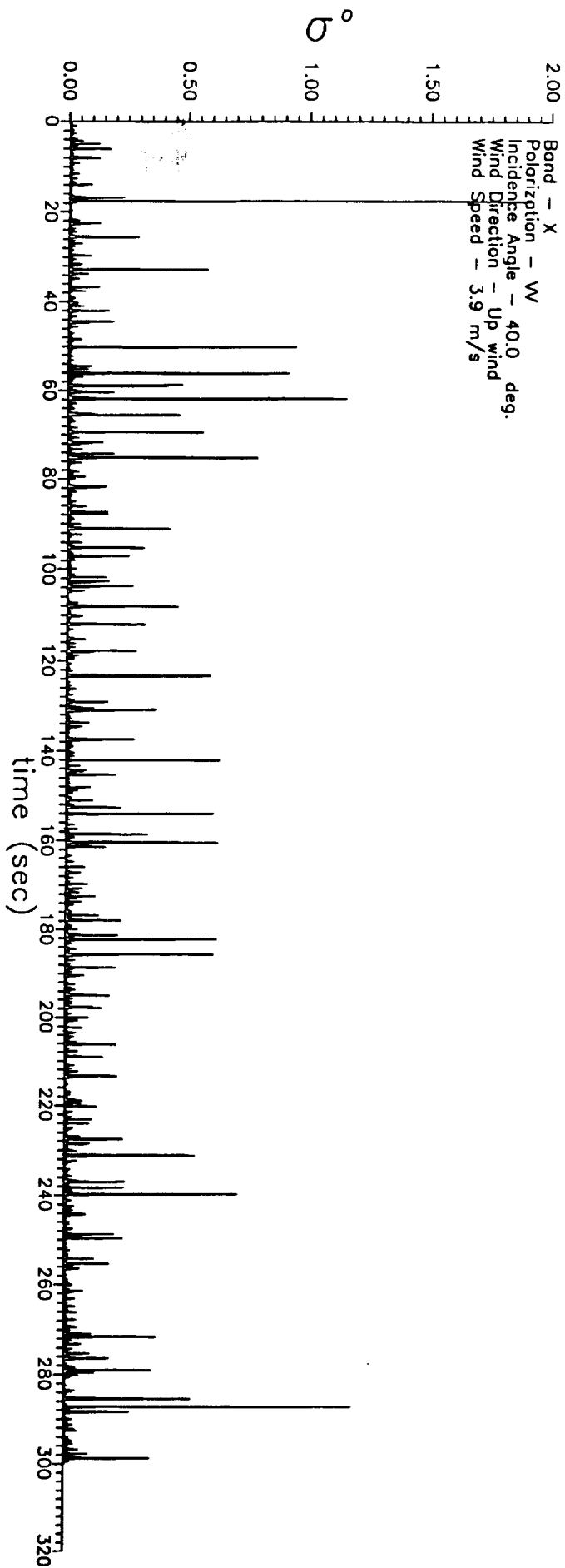
Run 23, 18:55, July 19, 1990

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.1 m/s



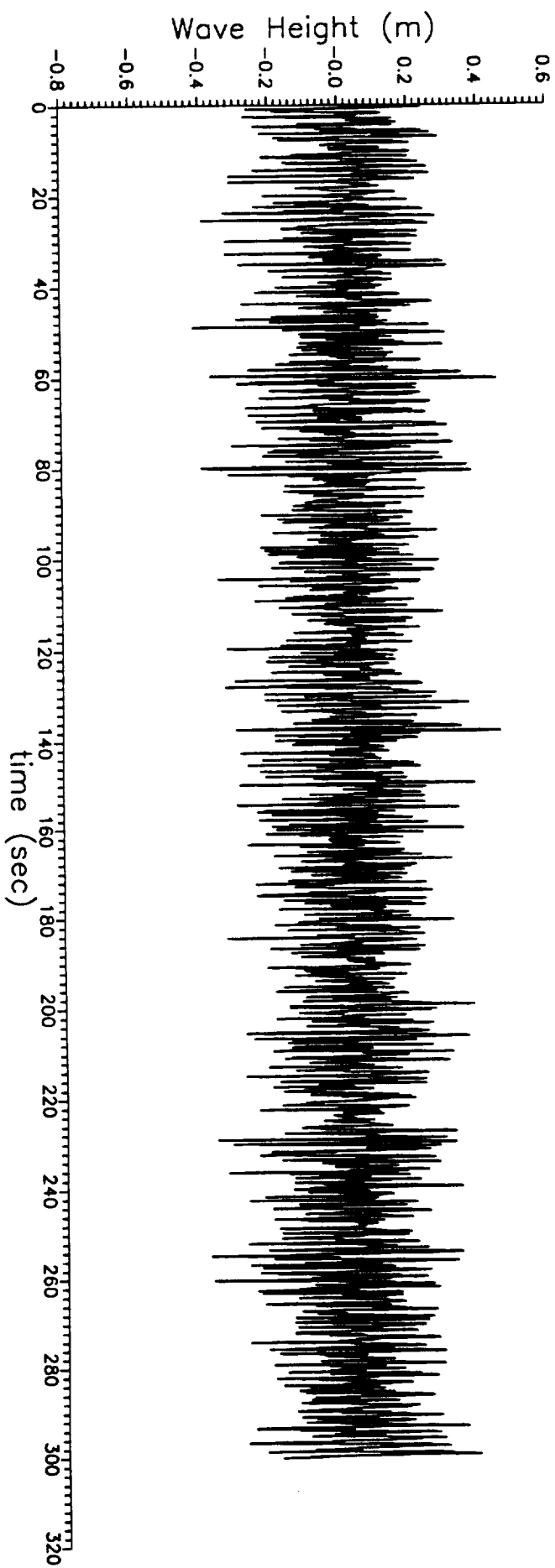
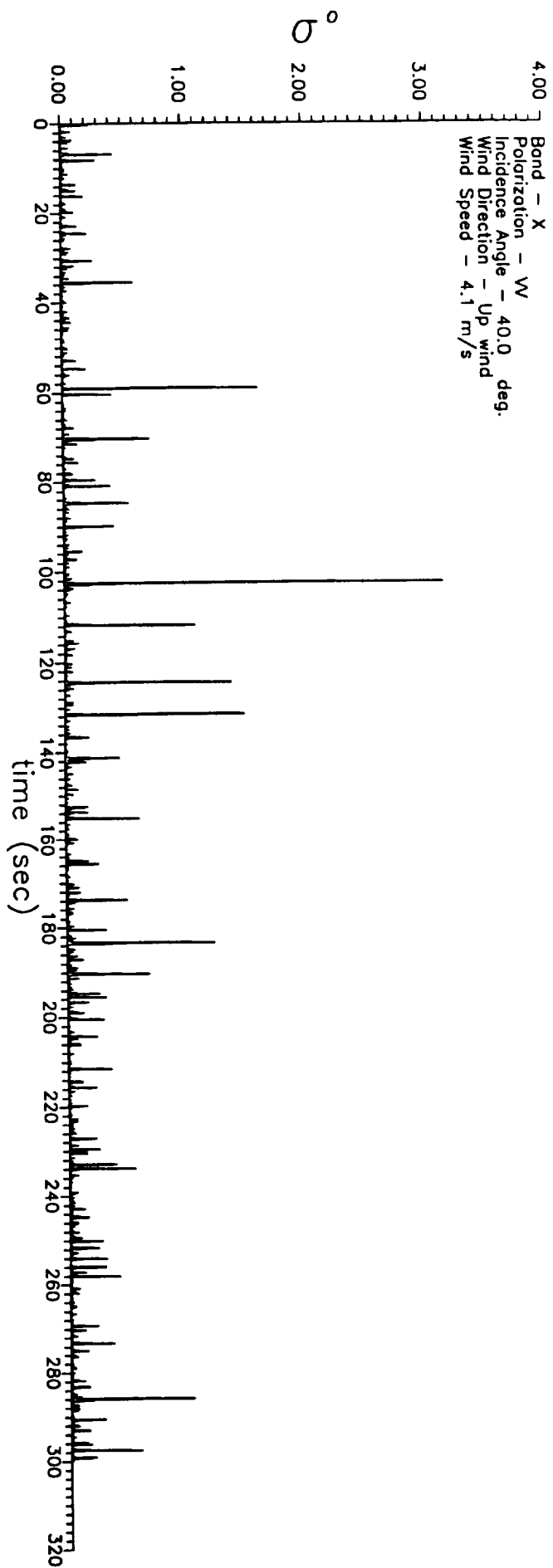
Run 13, 14:03, July 25, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 3.9 m/s



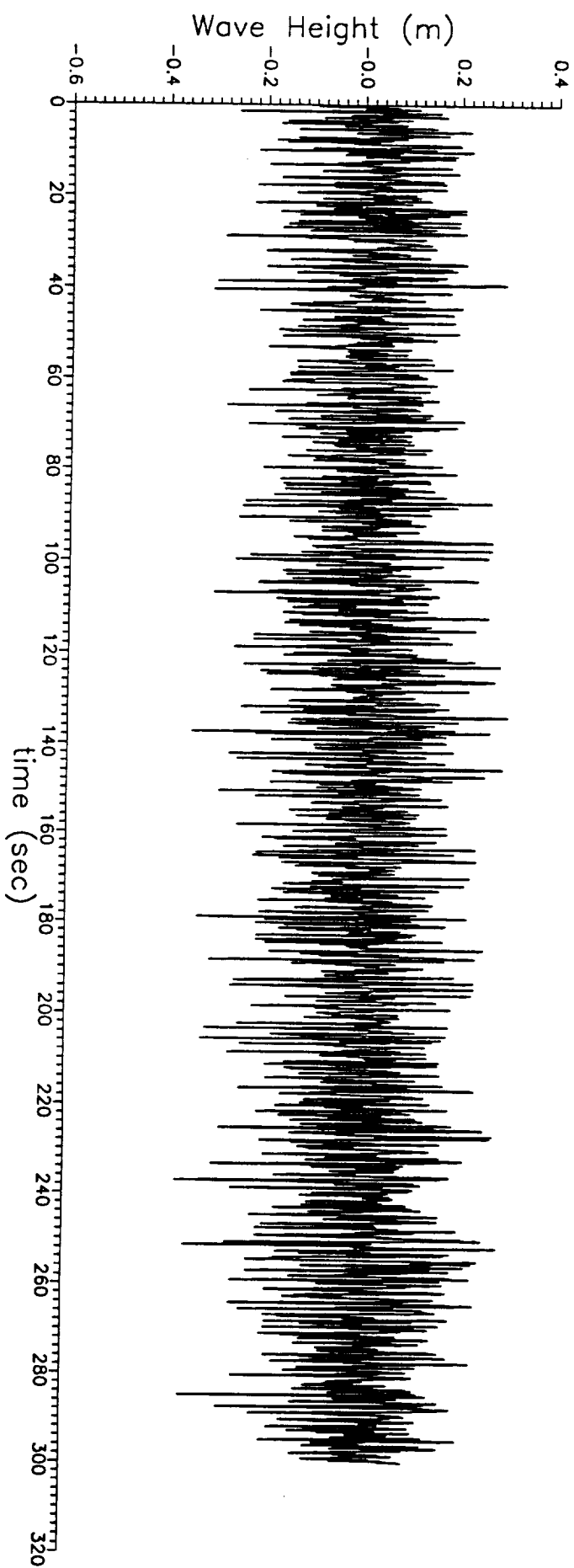
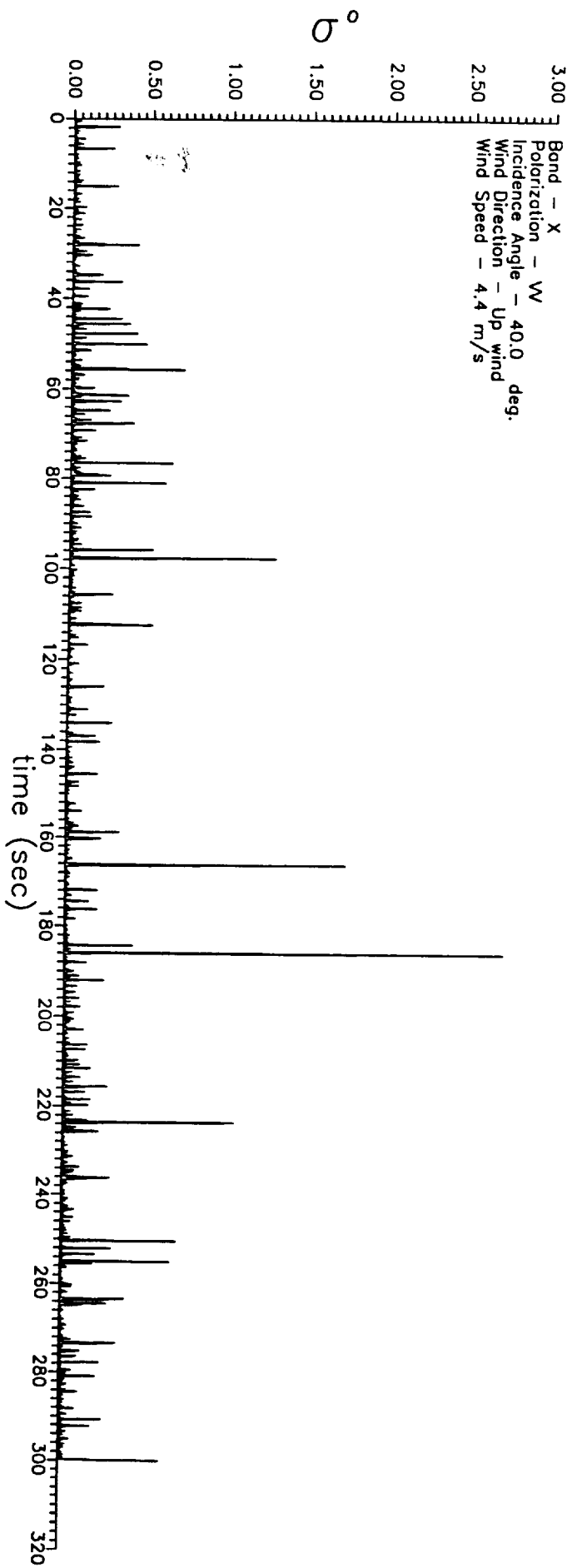
Run 14, 14:08, July 25, 1990

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.1 m/s



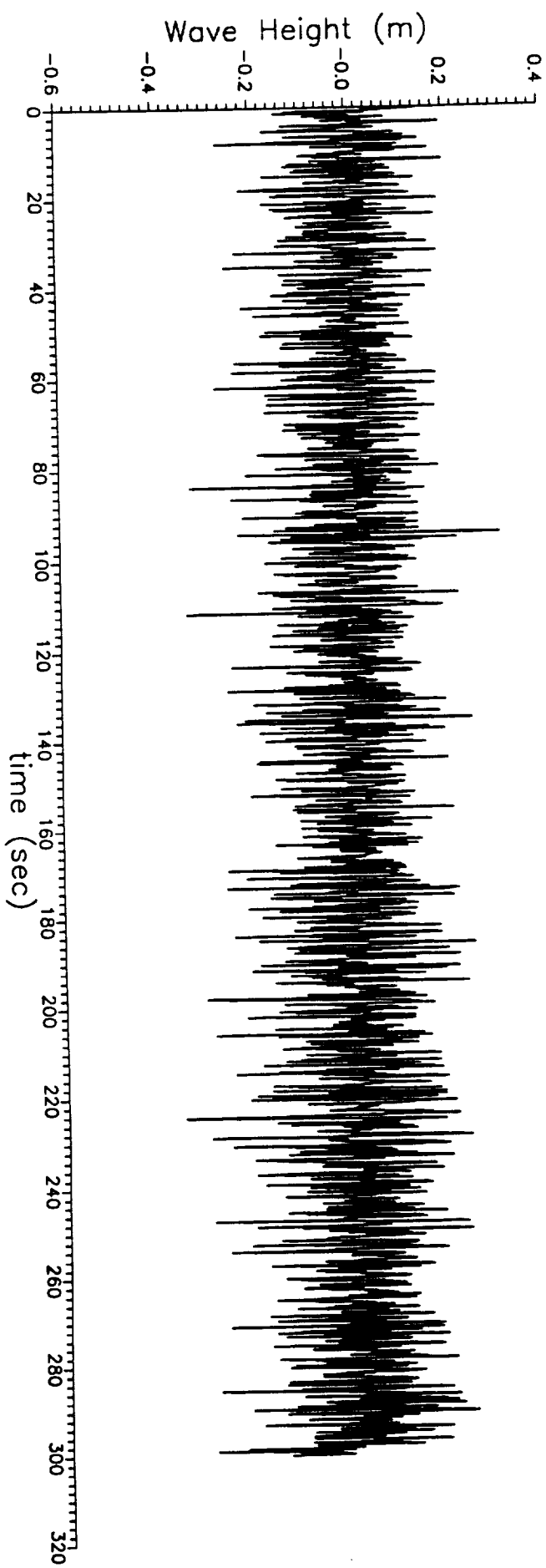
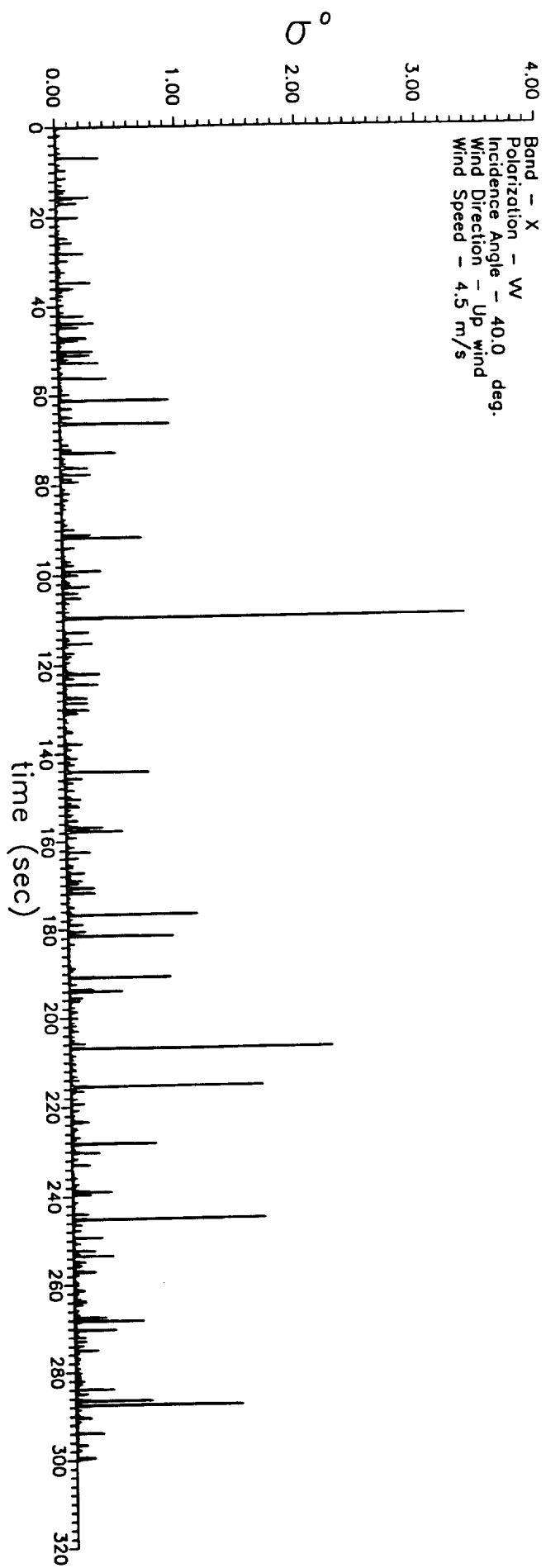
Run 11, 13:52, July 25, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s



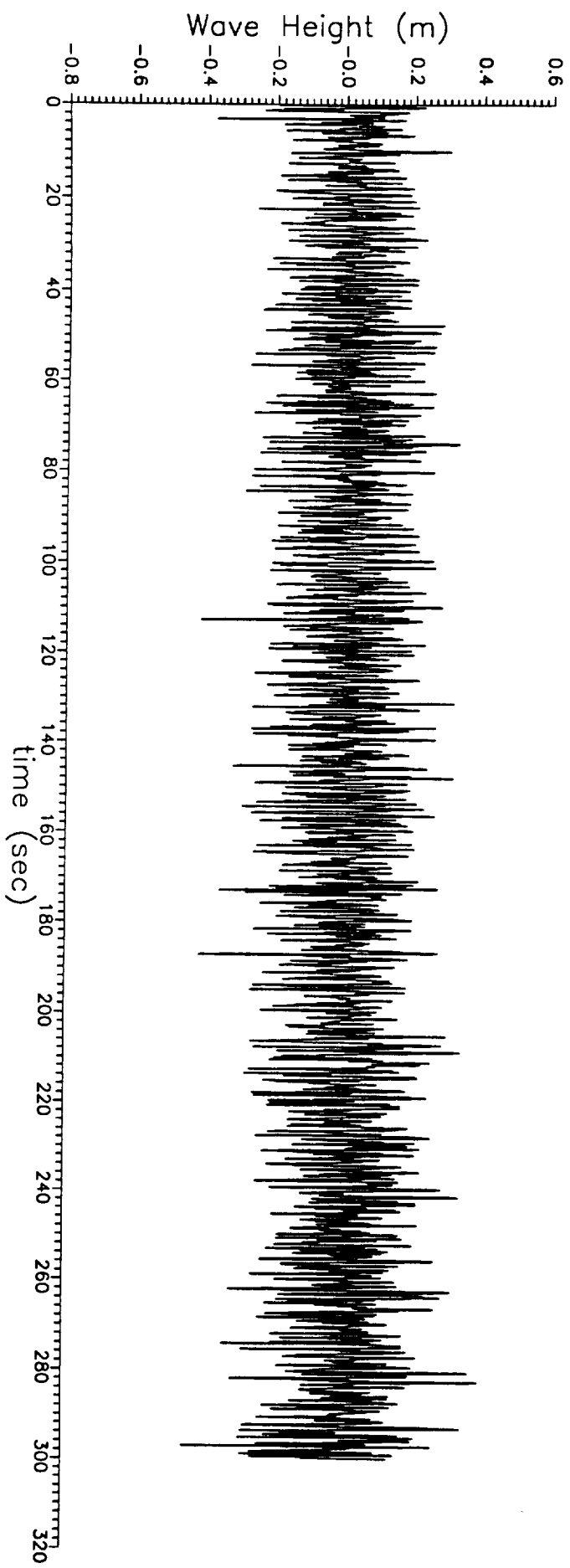
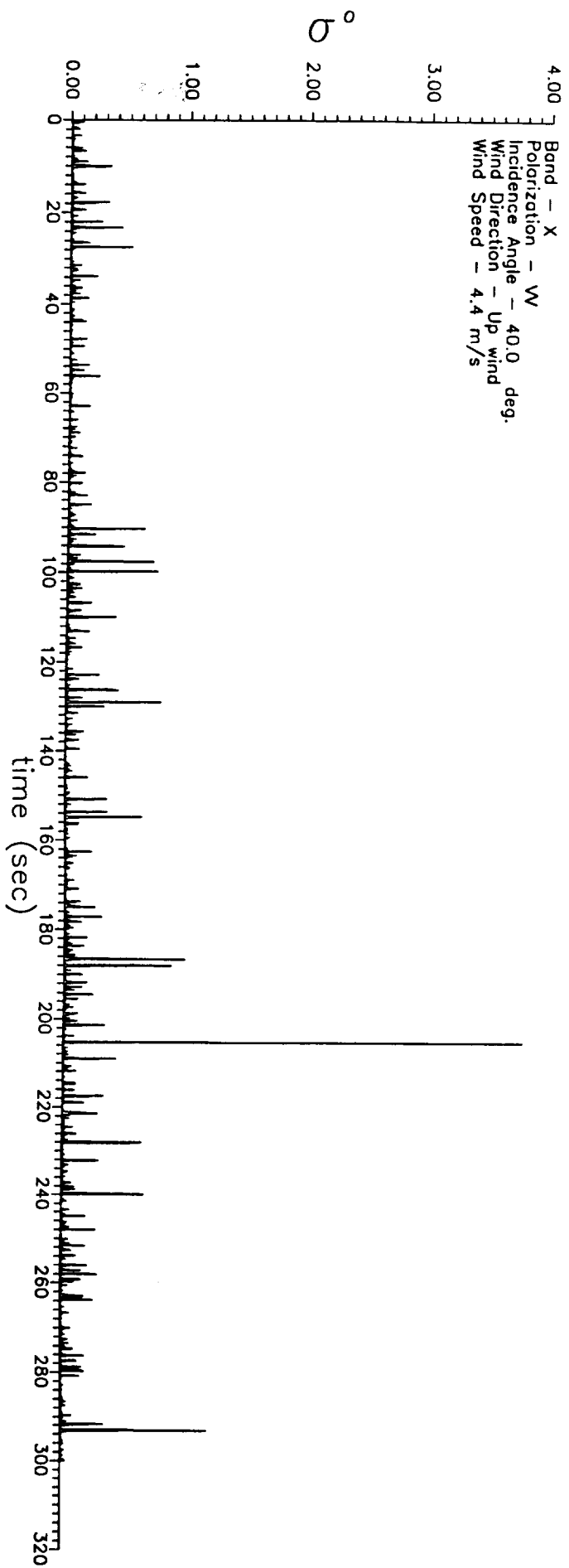
Run 9, 13:39, July 25, 1990

Band - X
Polarization - VV
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.5 m/s

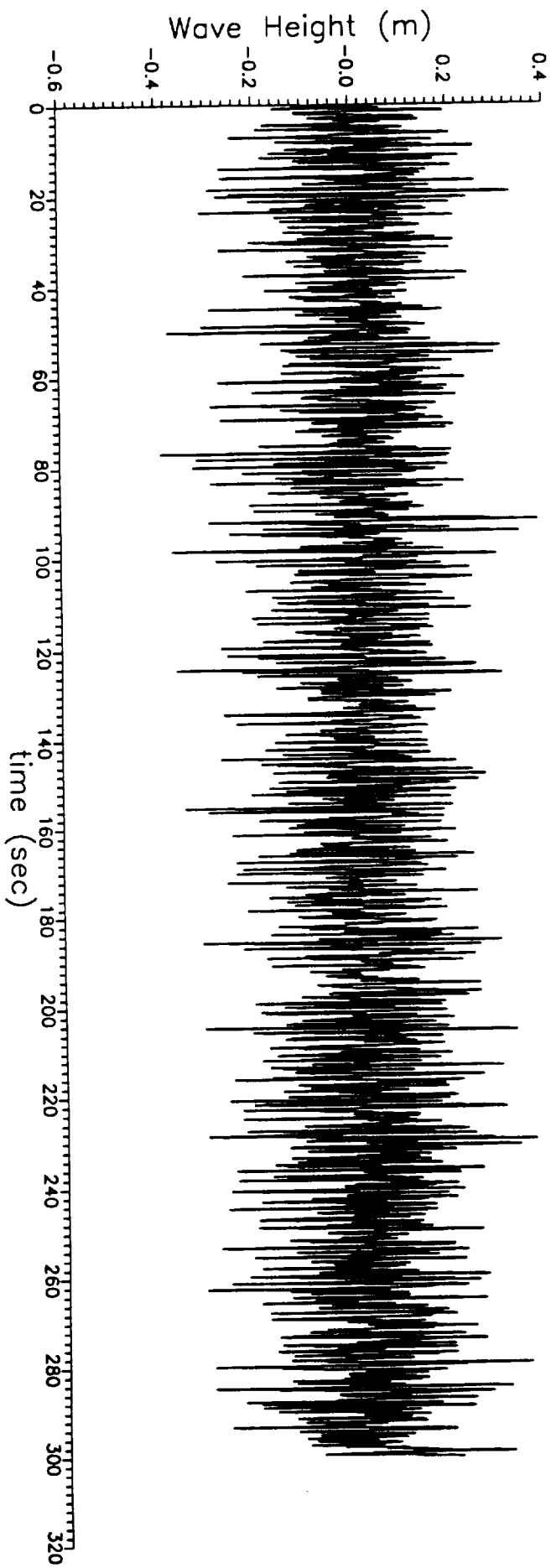
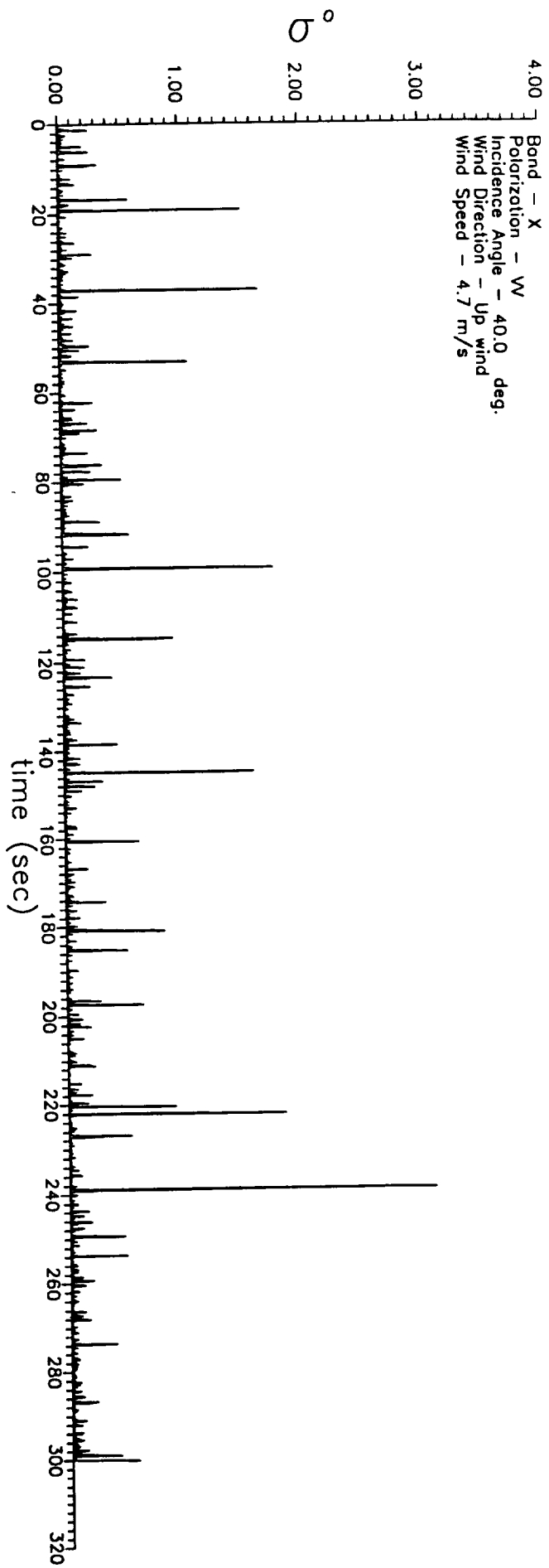


Run 12, 113:58, July 25, 1990

Band - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s

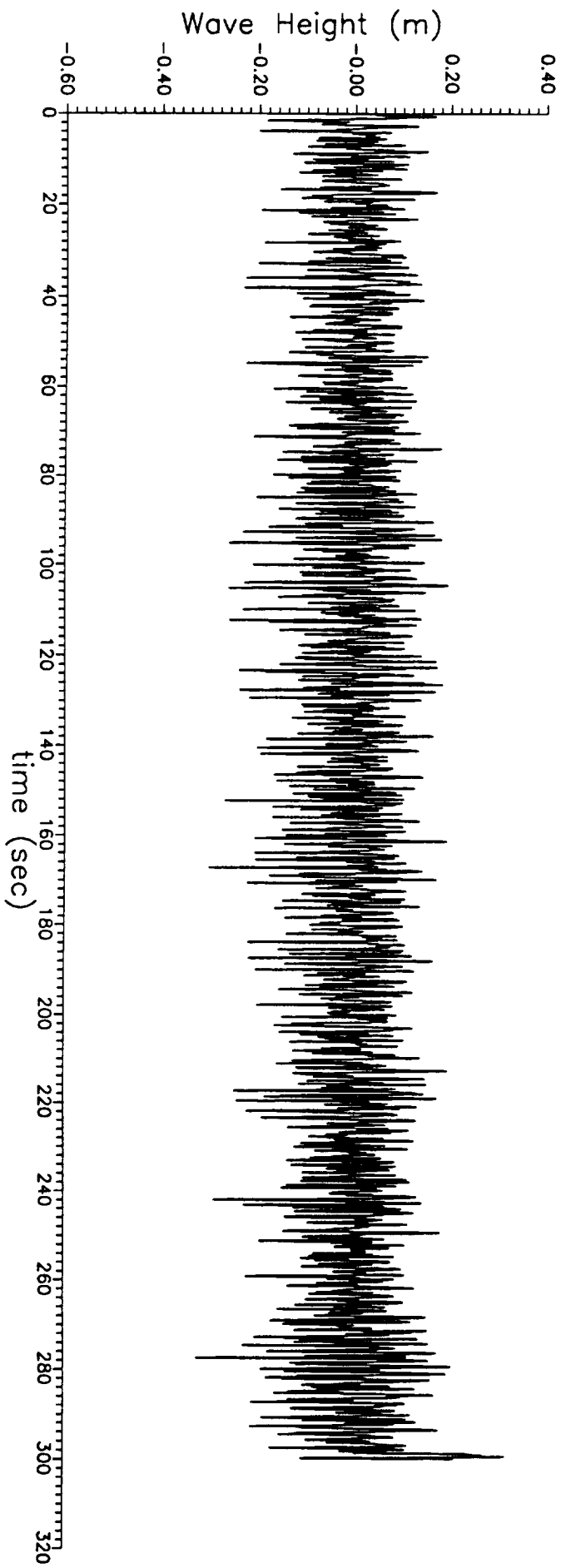
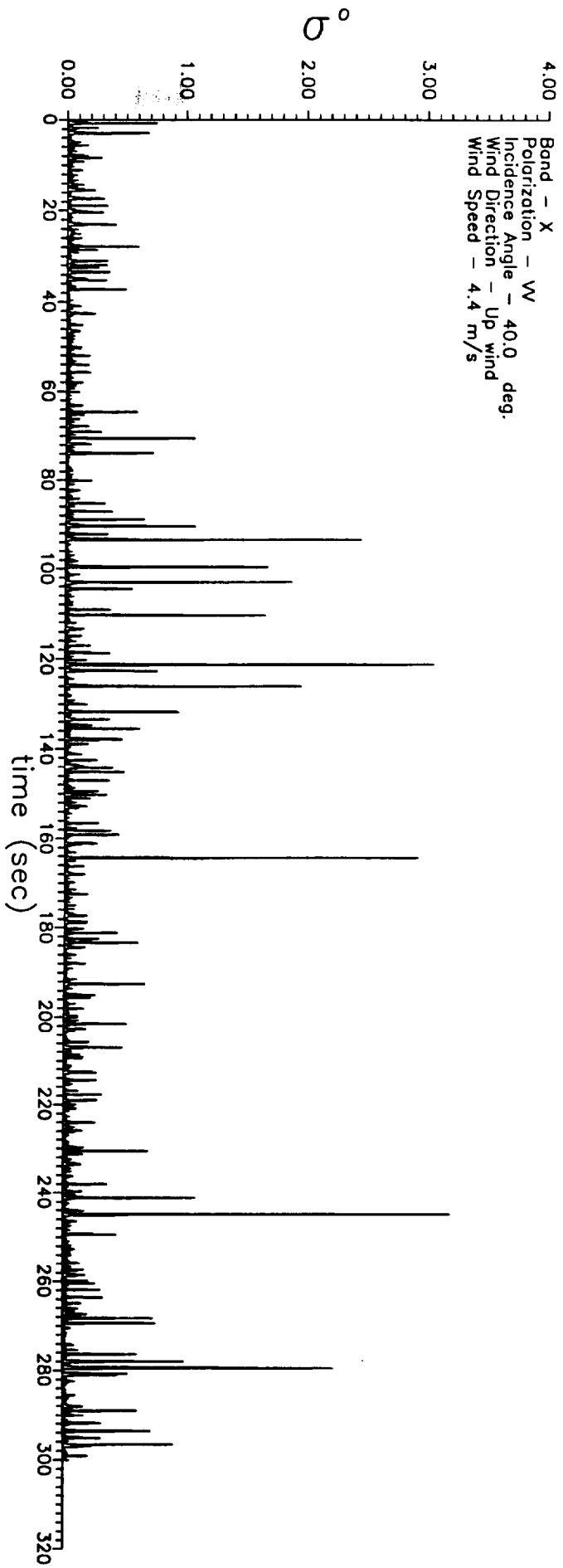


Run 16, 14:19, July 25, 1990

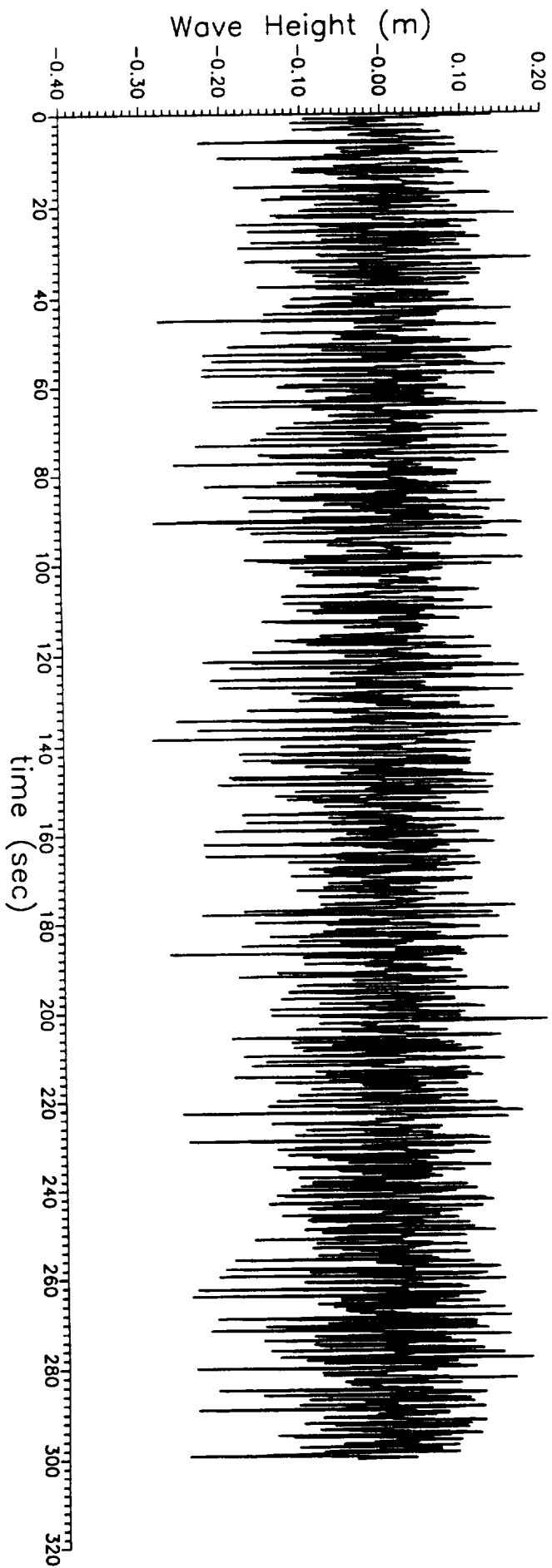
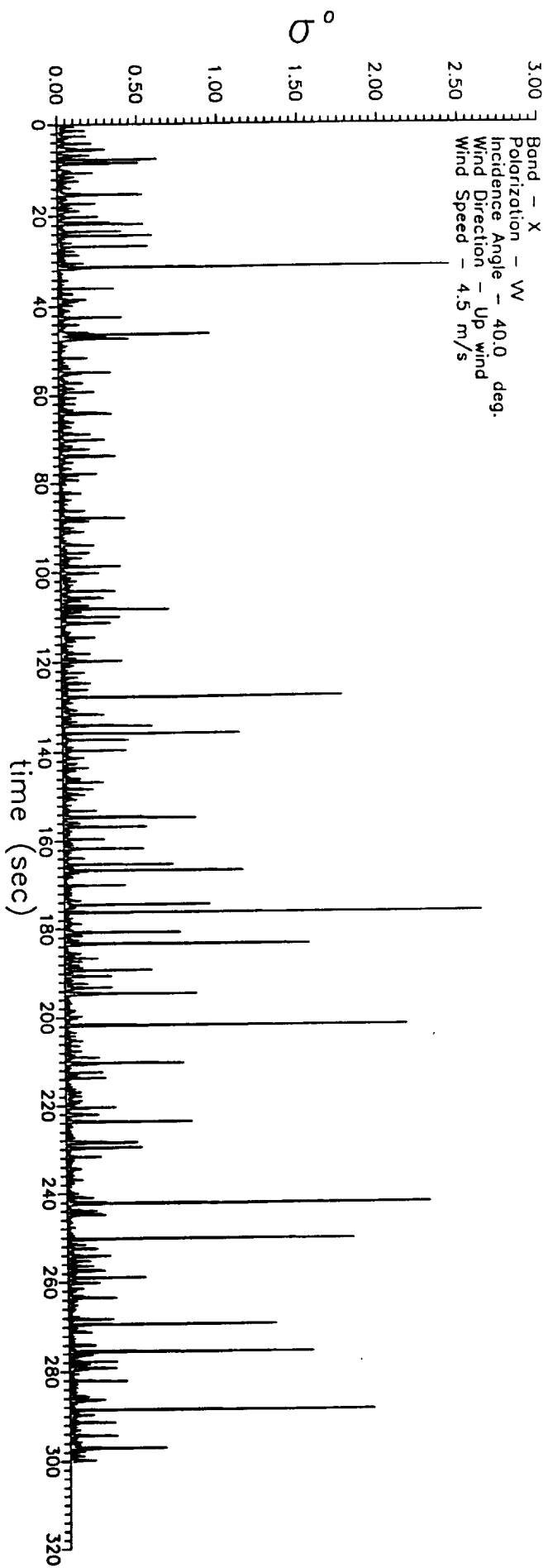


Run 12, 18:34, Aug 7, 1990

Band - X
Polarization - V
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.4 m/s

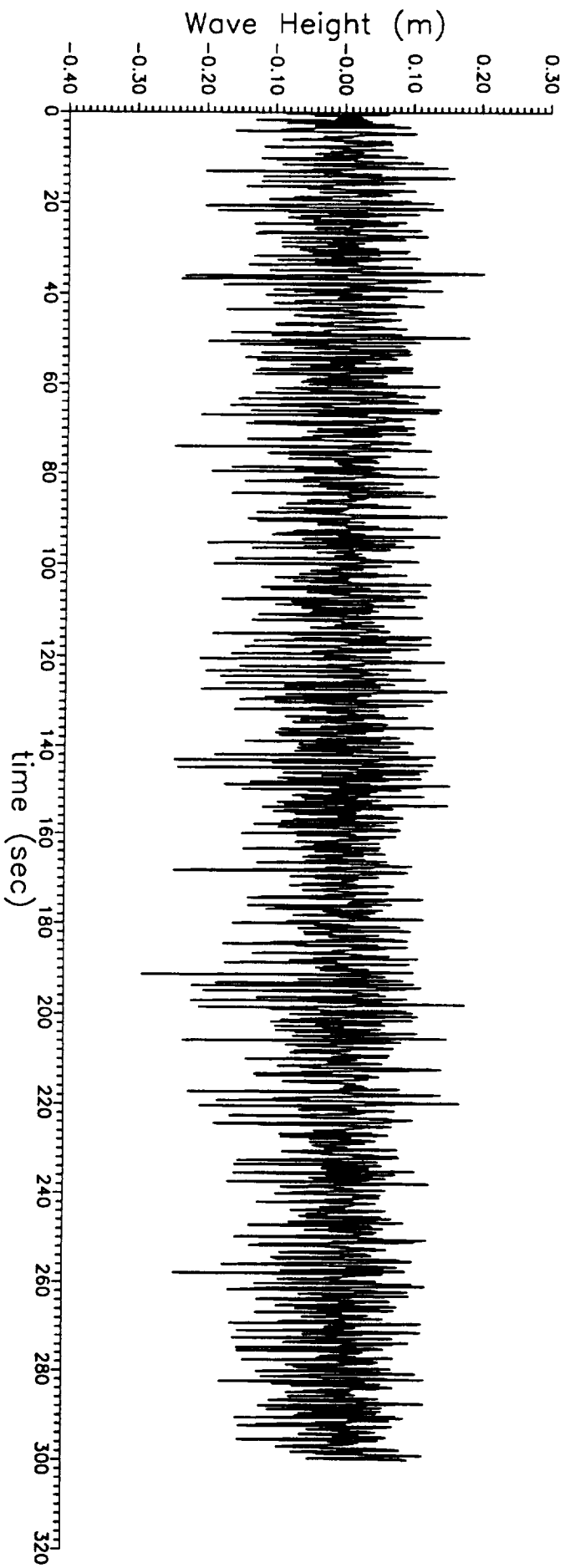
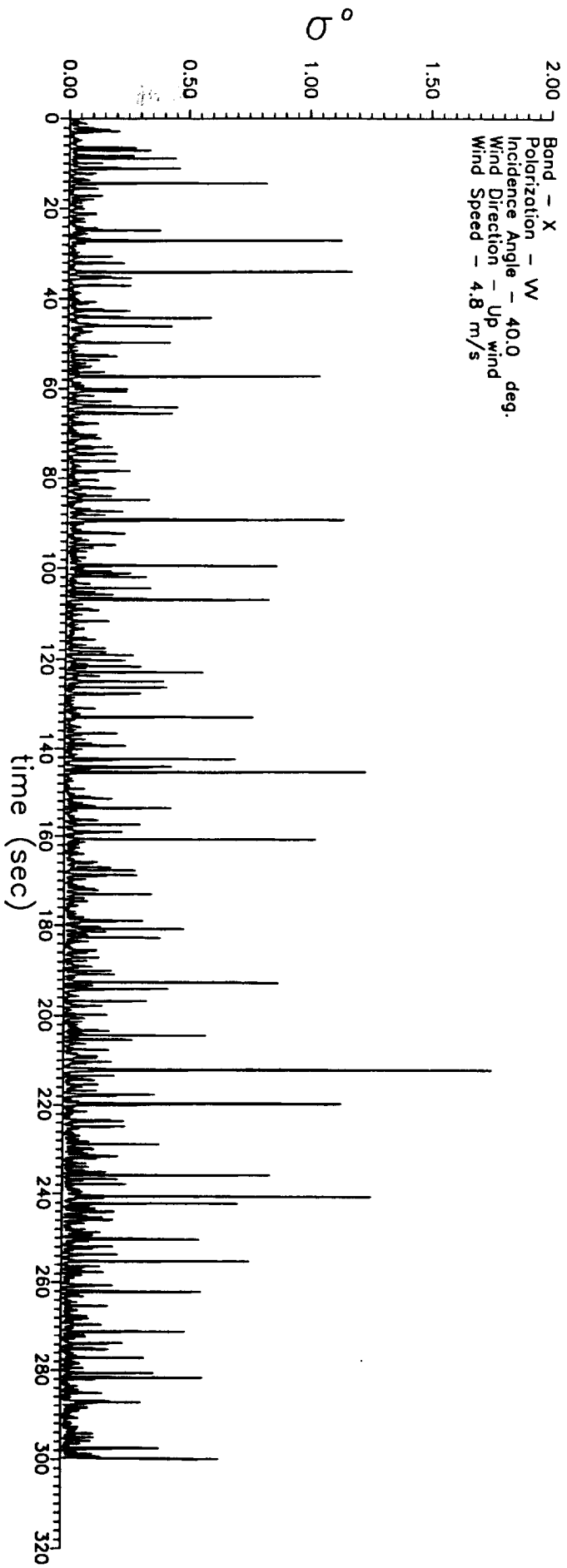


Run 13, 18:39, Aug 7, 1990



Run 14, 18:45, Aug 7, 1990

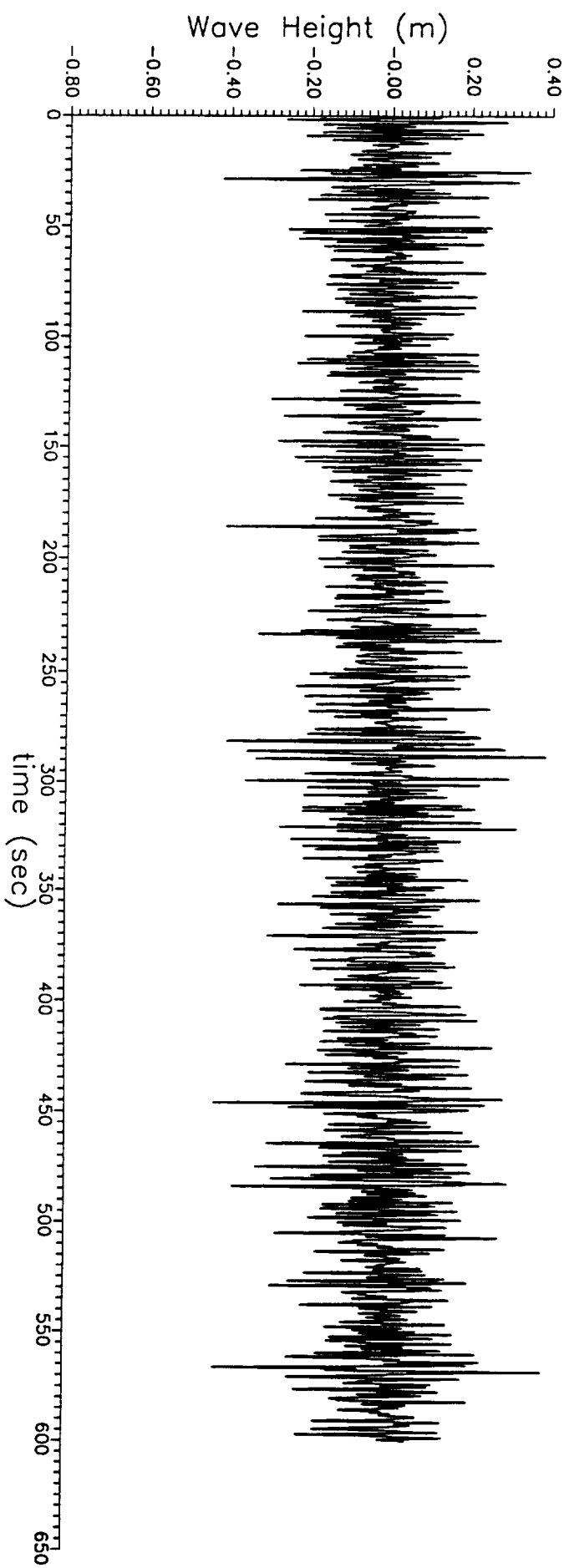
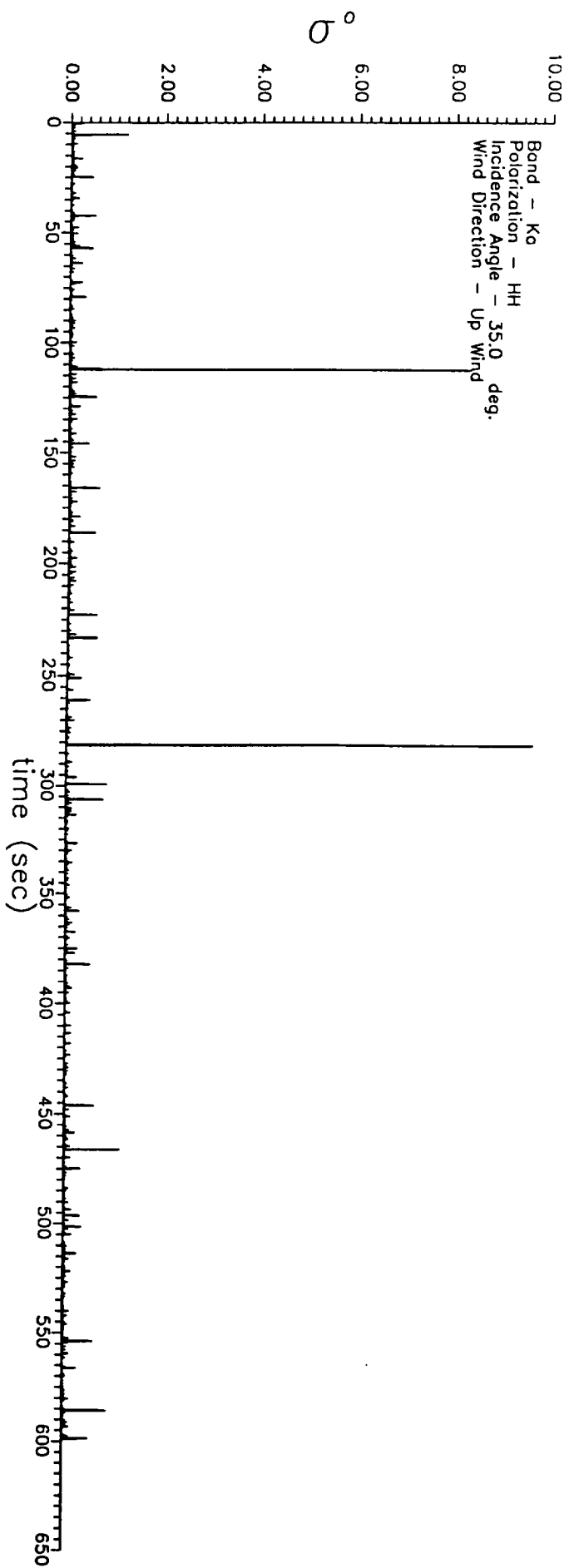
Bond - X
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 4.8 m/s



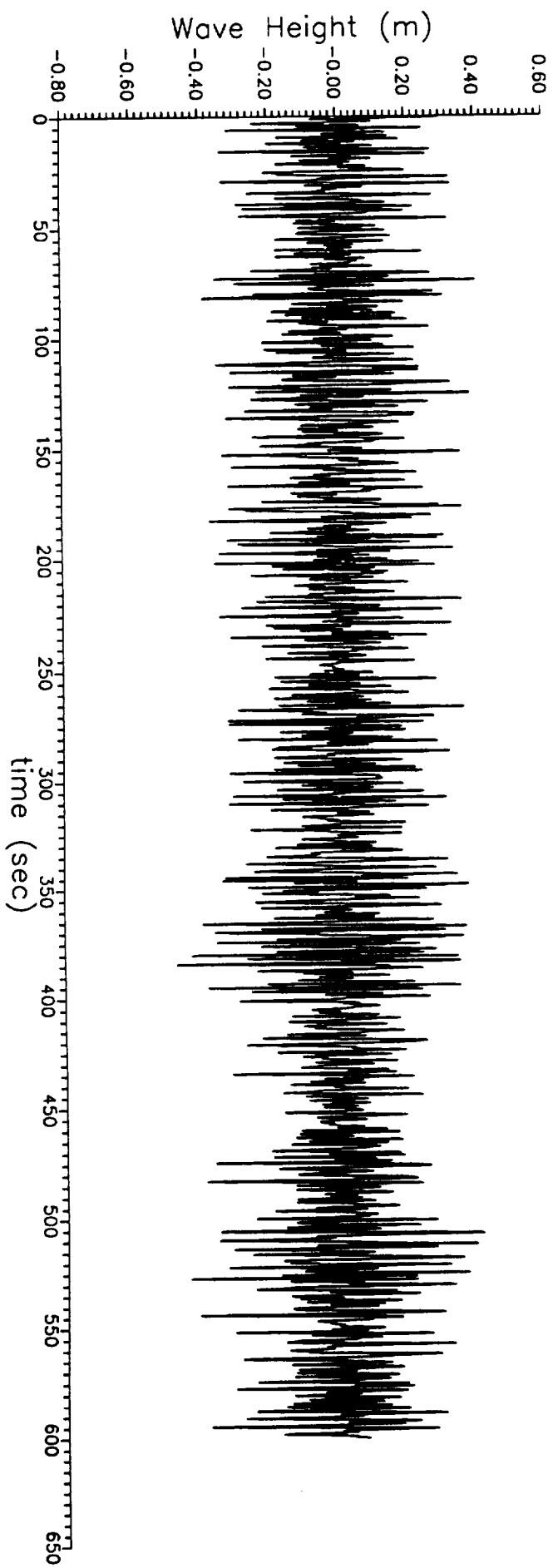
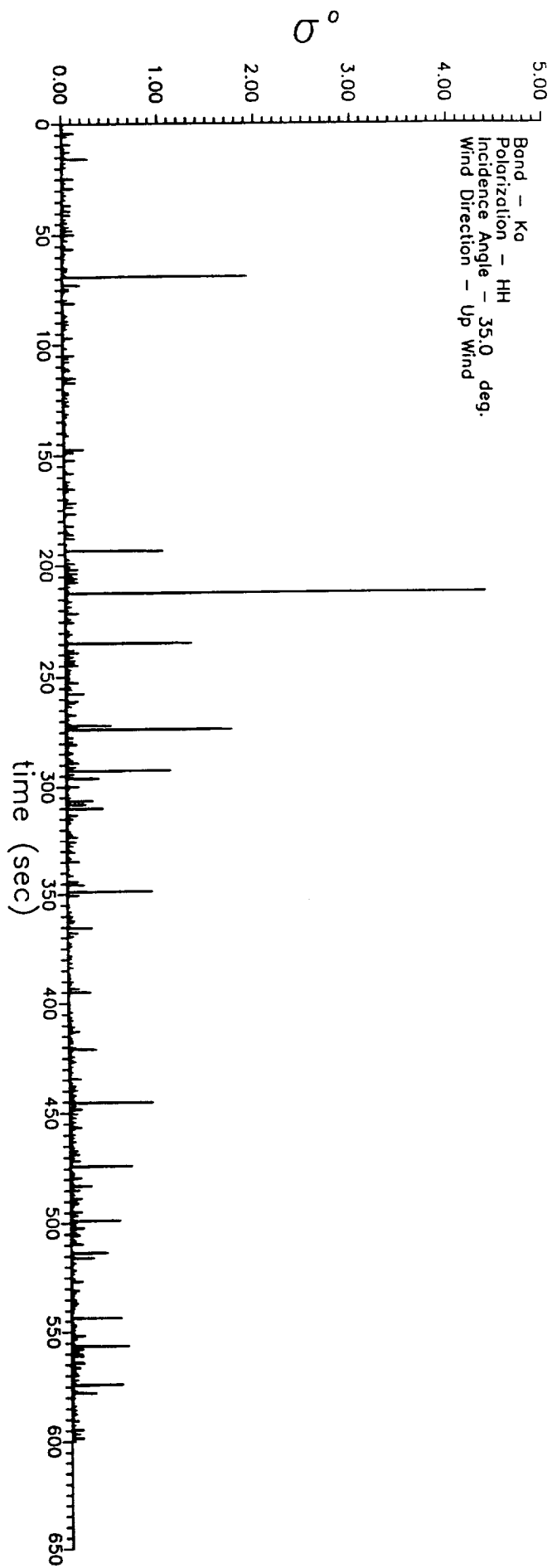
B-3. Ka Band



Run 8, 19:45, July 16, 1990

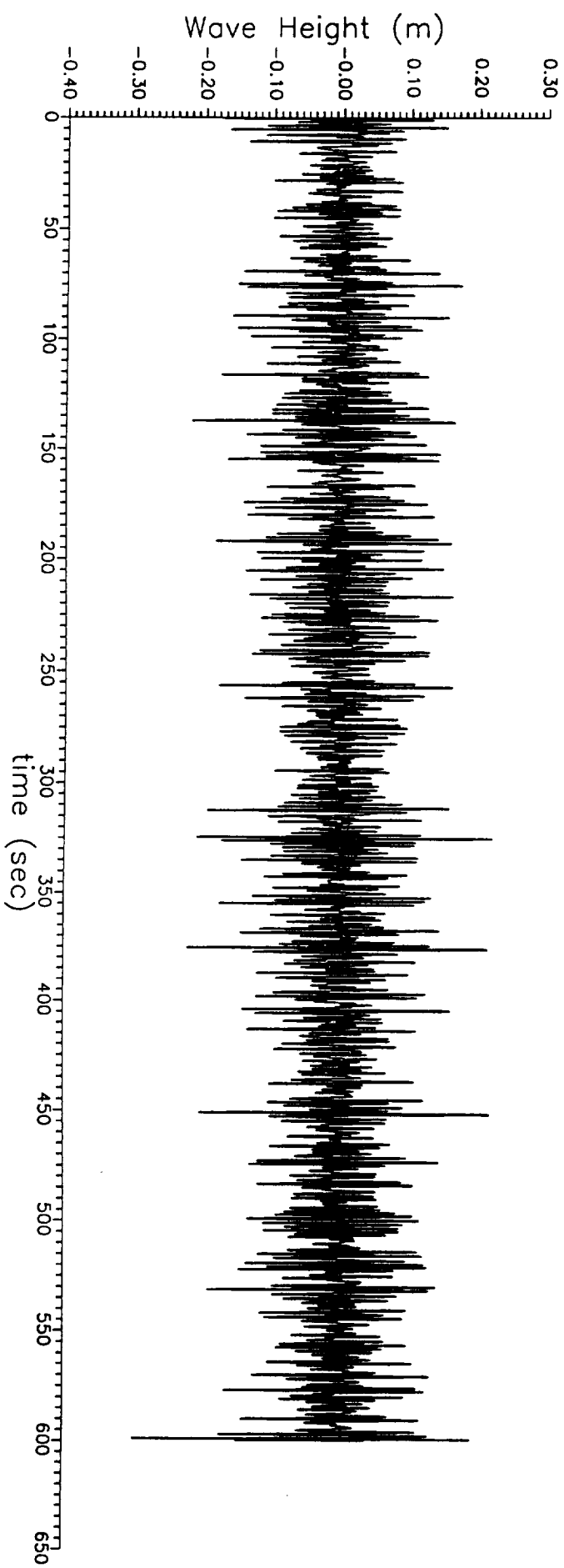
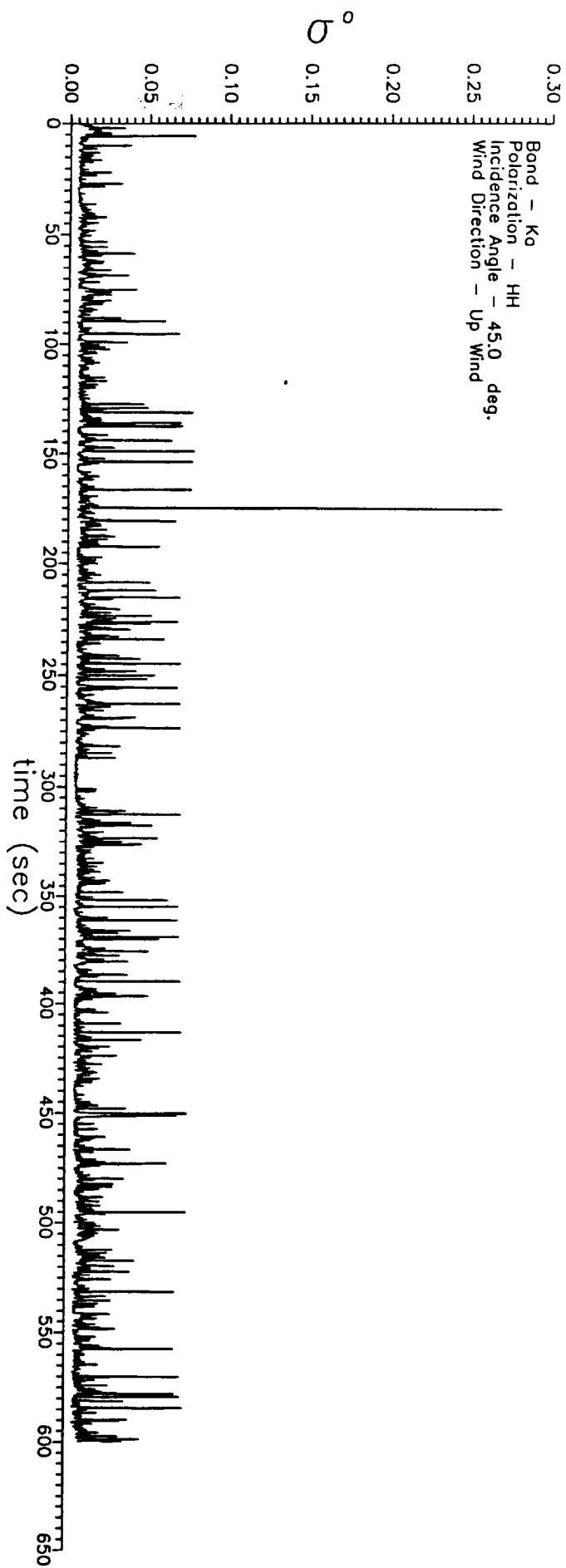


Run 10, 20:28, July 16, 1990

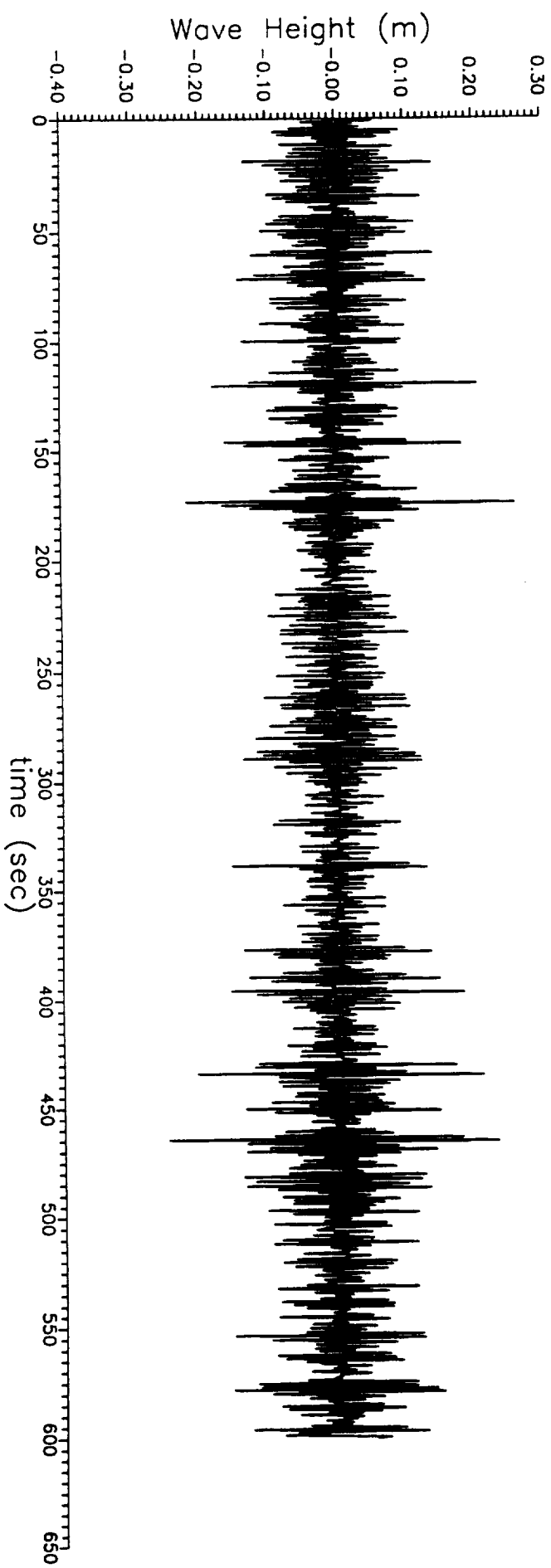
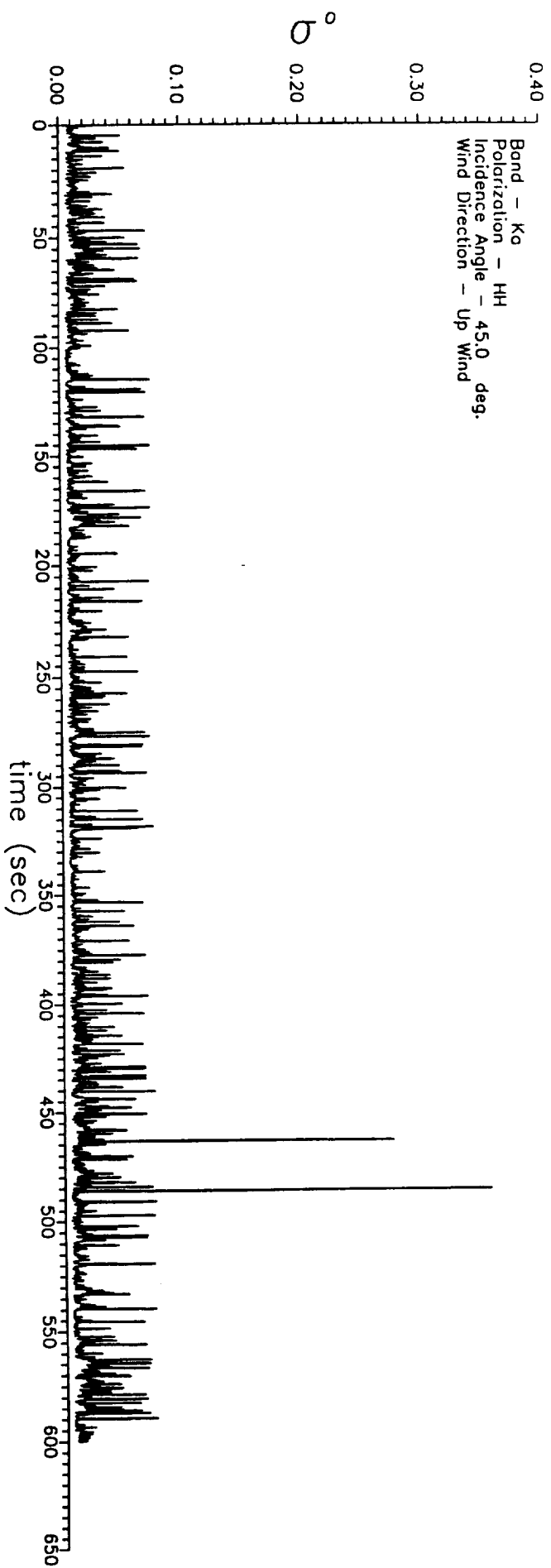


Run 5, 19:08, July 17, 1990

Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

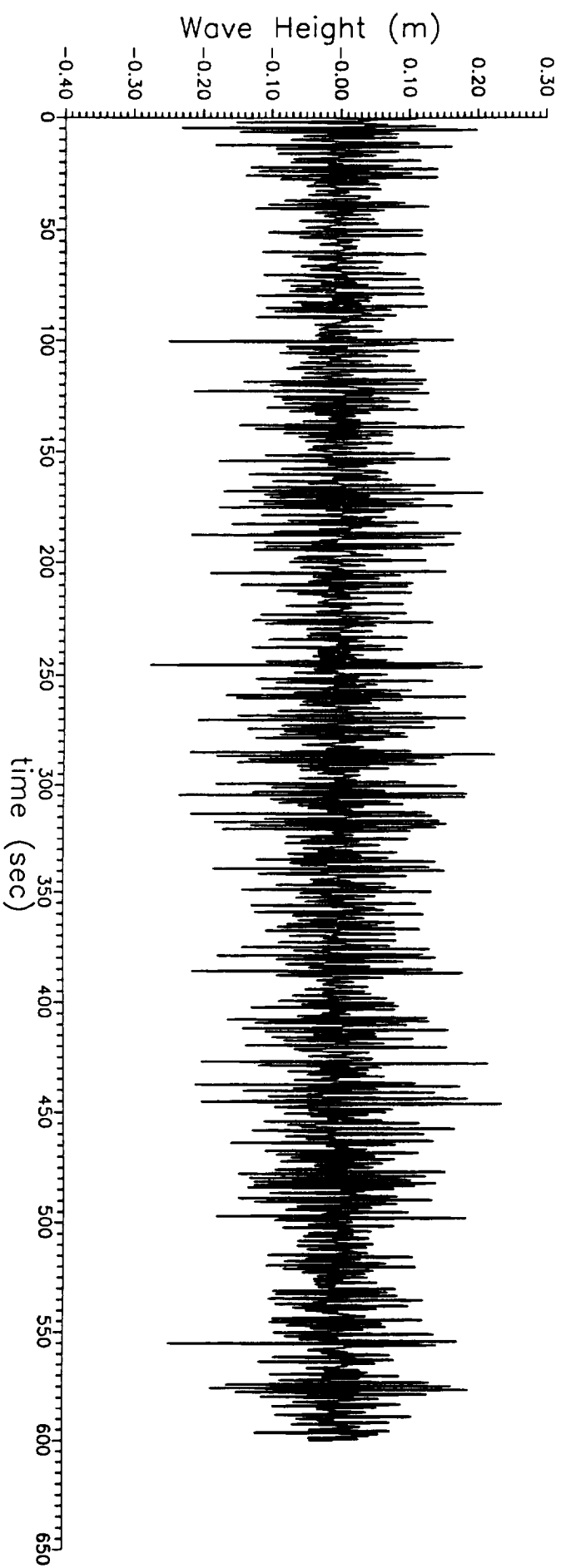
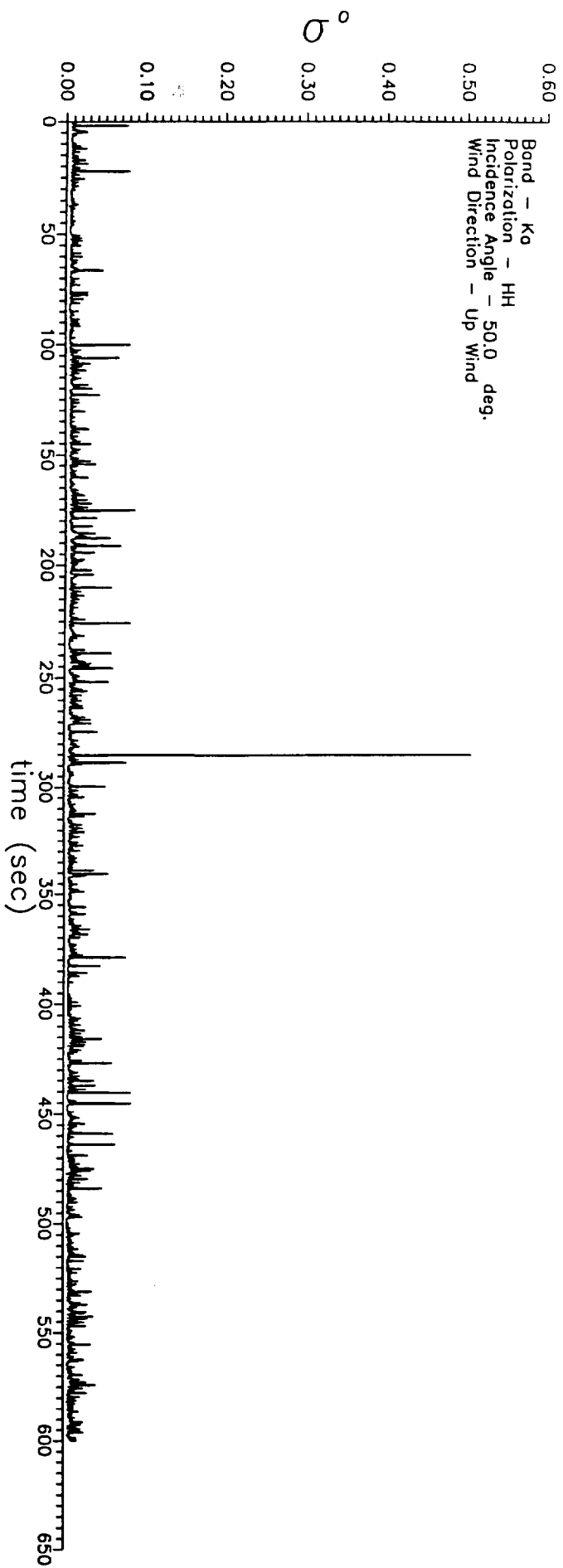


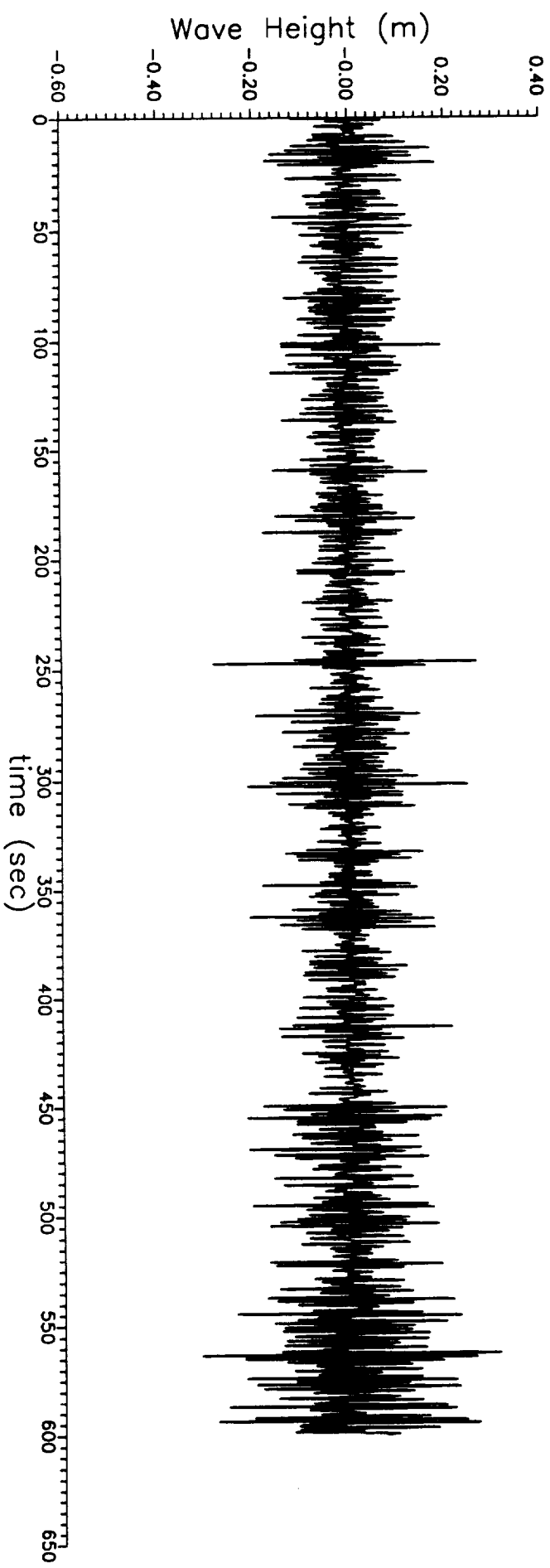
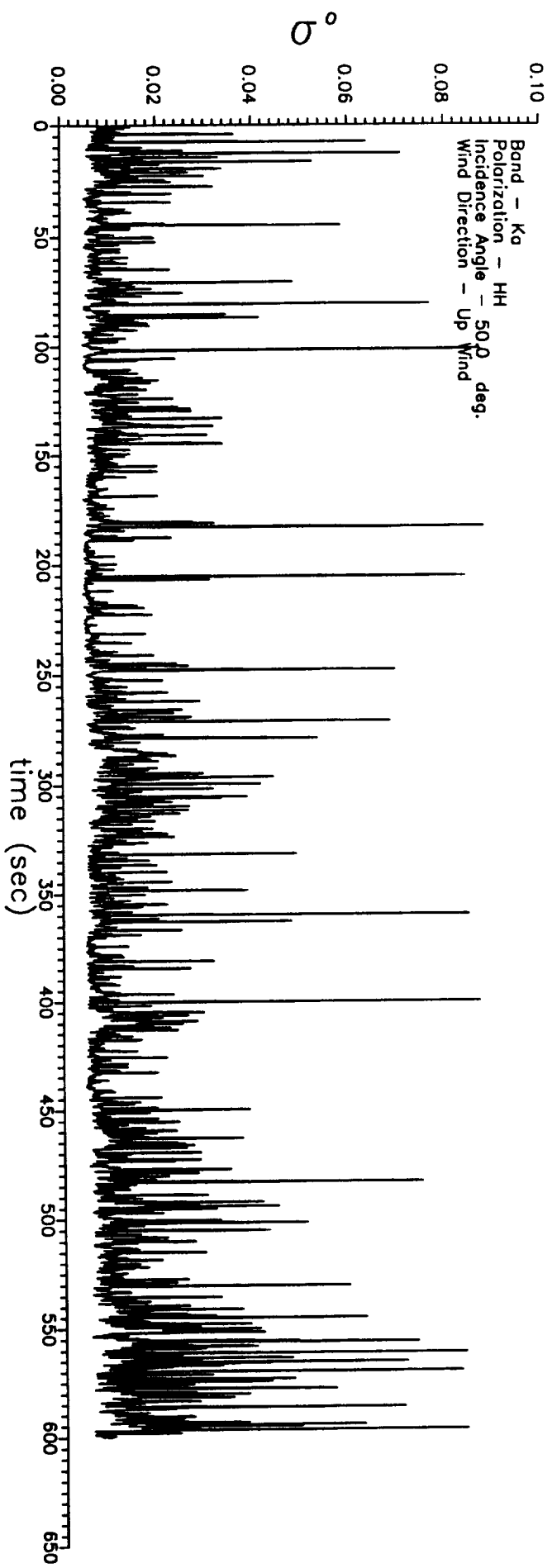
Run 6, 19:34, July 17, 1990



Run 7, 19:49, July 17, 1990

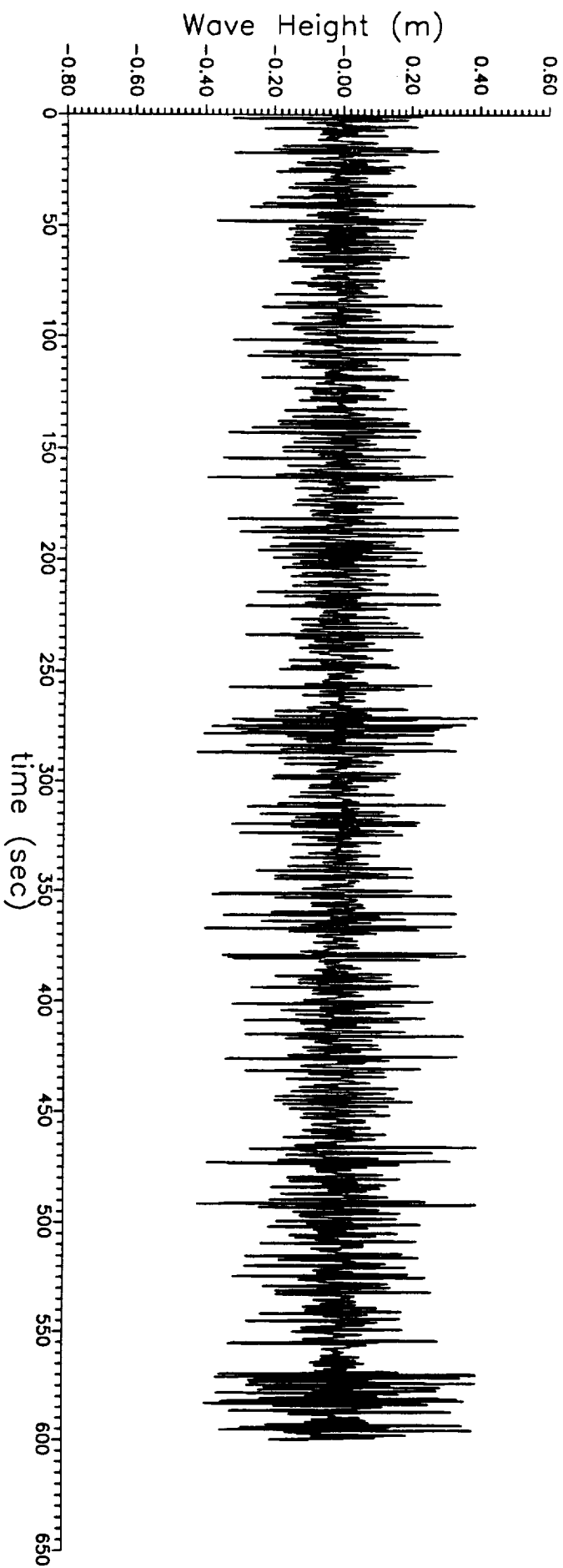
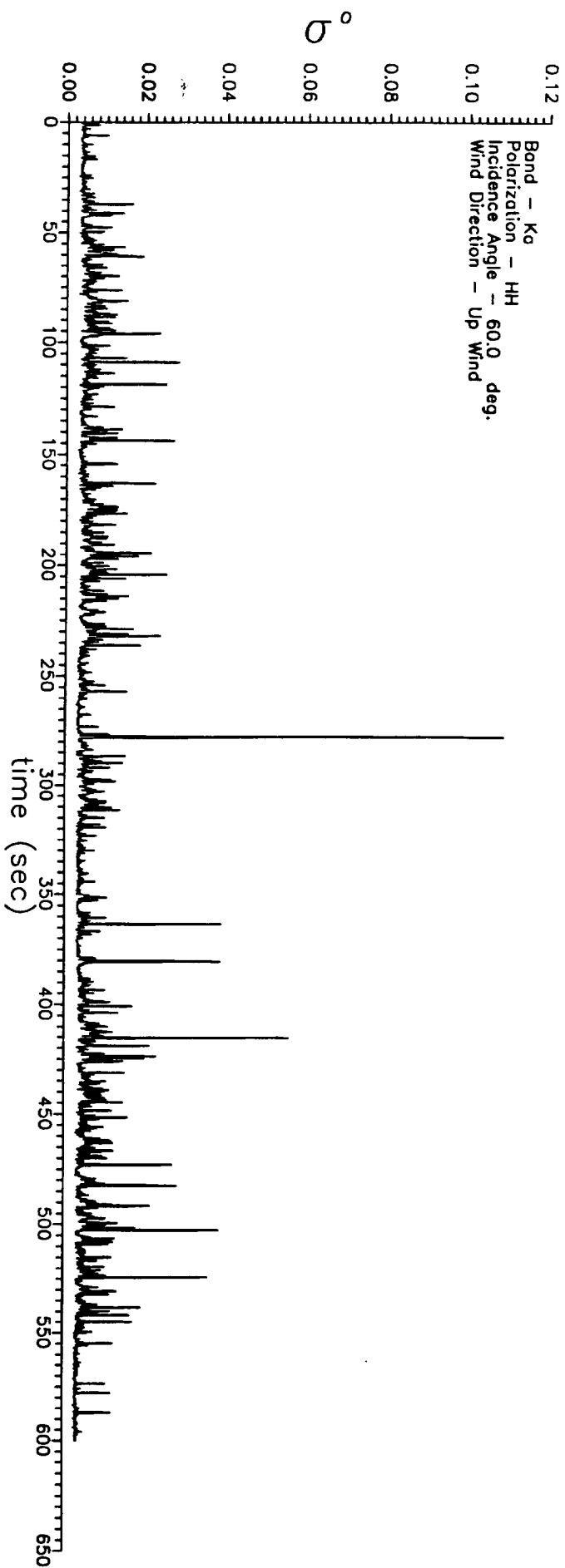
Bond - Ka
Polarization - HH
Incidence Angle - 50.0 deg.
Wind Direction - Up Wind





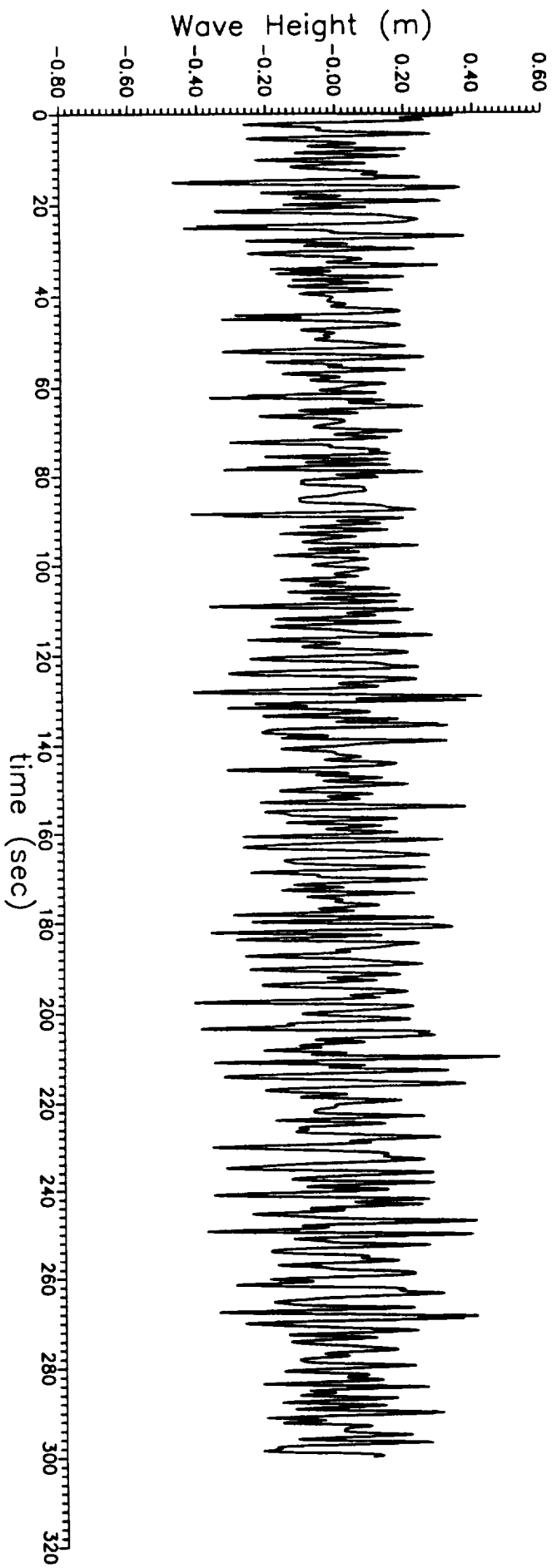
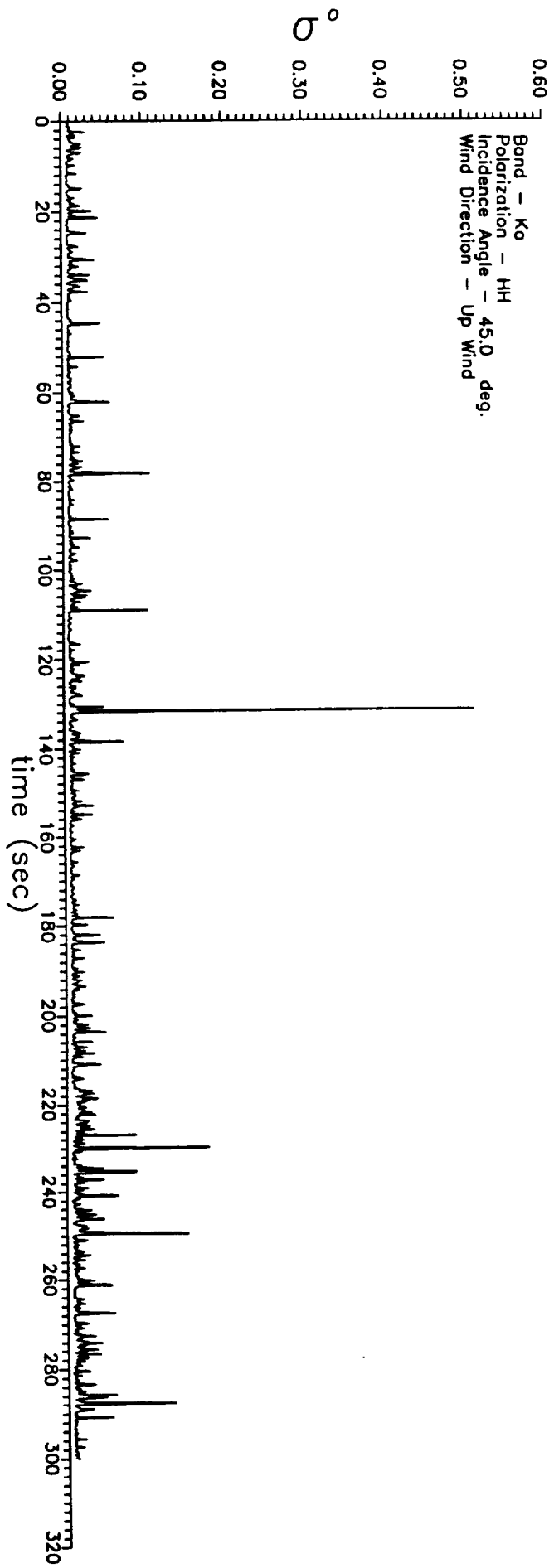
Run 10, 20:58, July 17, 1990

Band - Ka
Polarization - HH
Incidence Angle - 60.0 deg.
Wind Direction - Up Wind

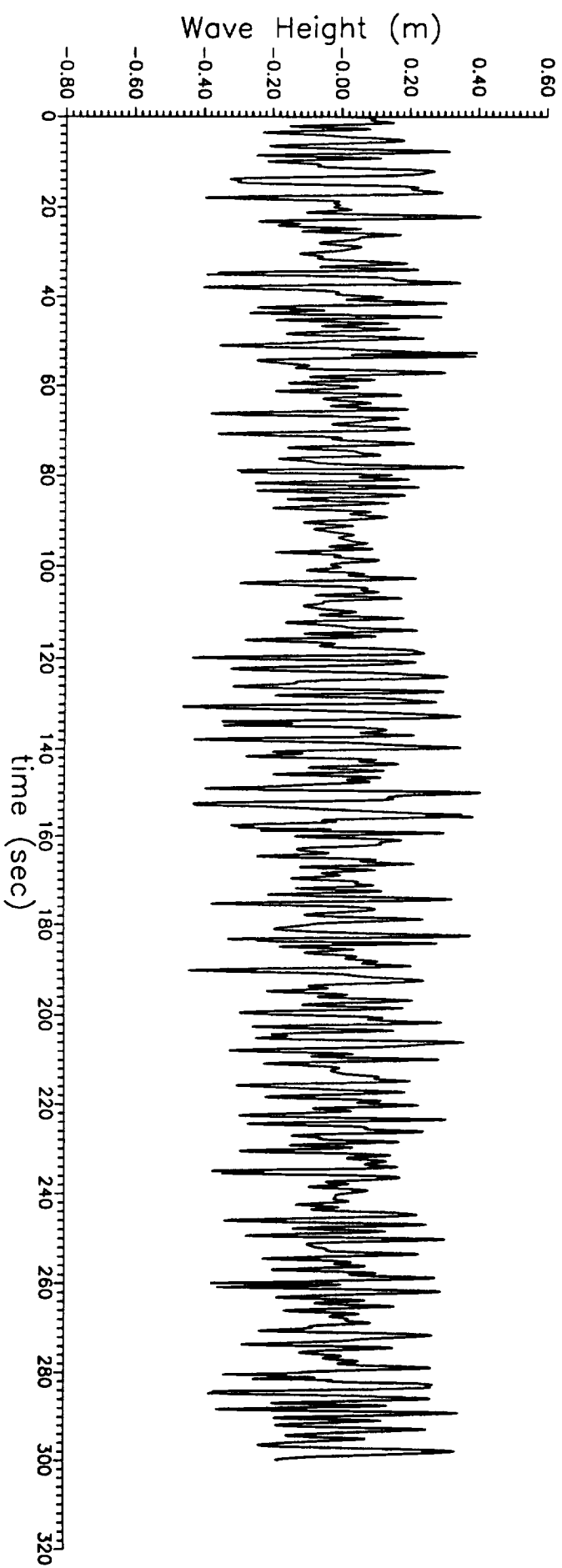
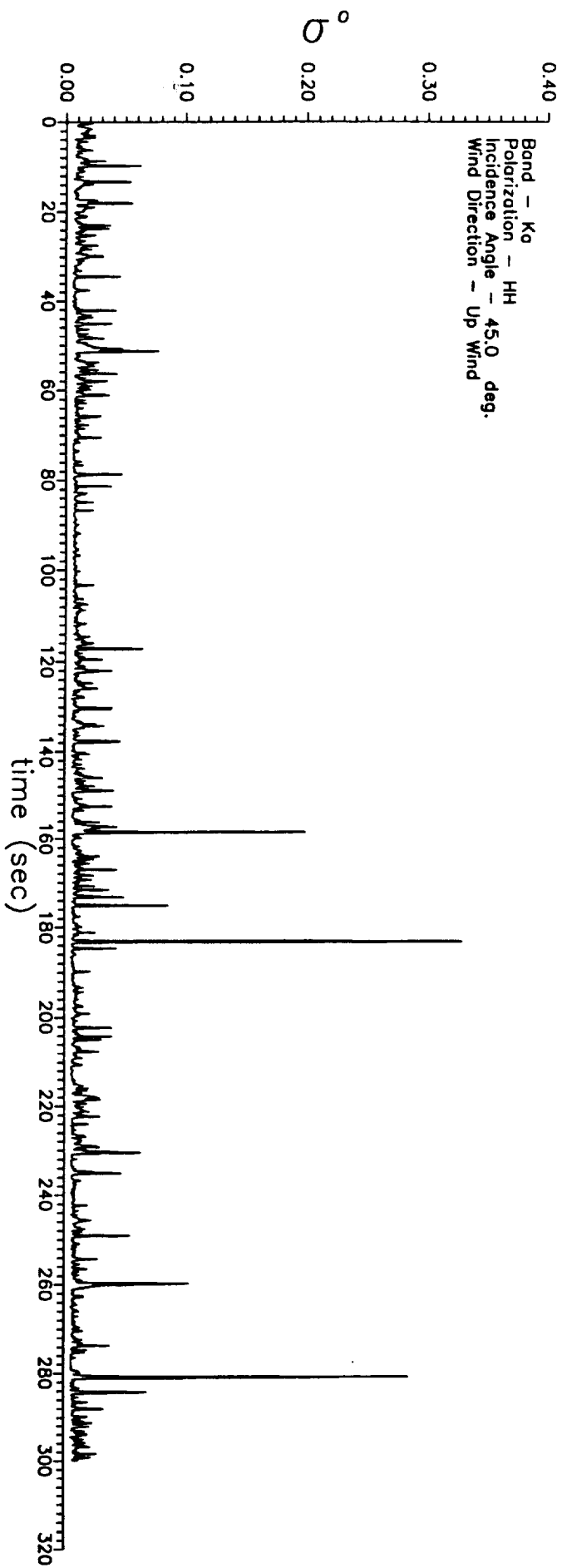


Run 17, 18:56, July 18, 1990

Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

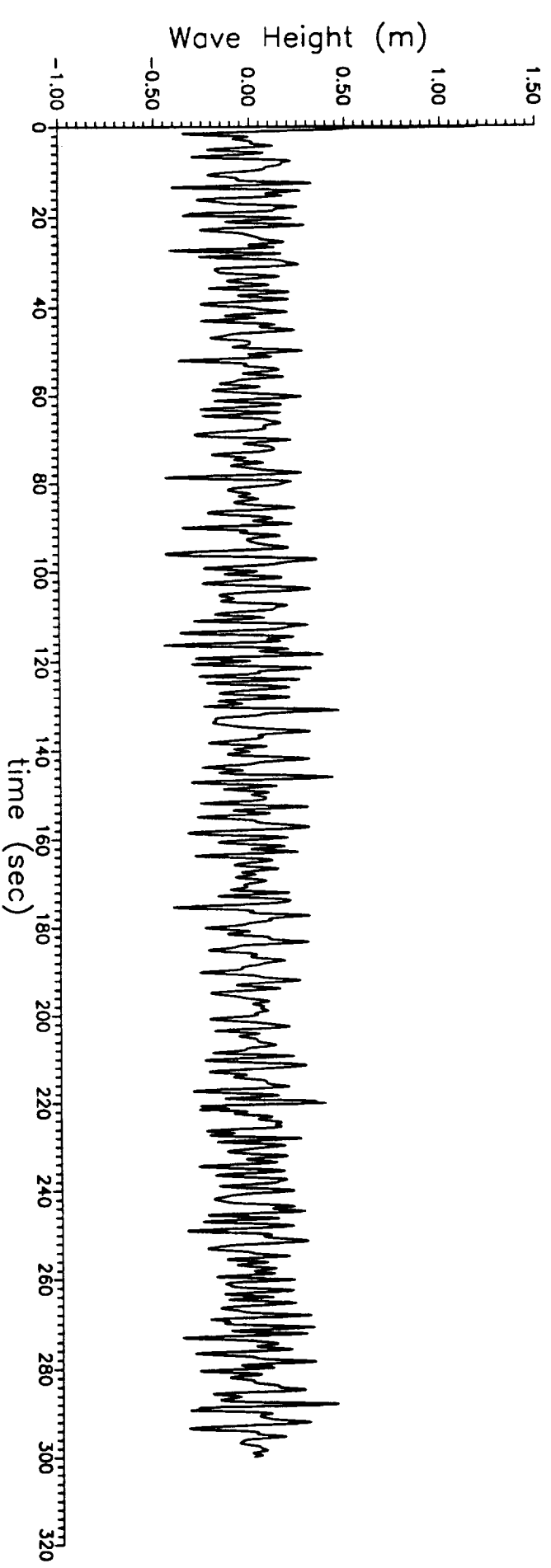
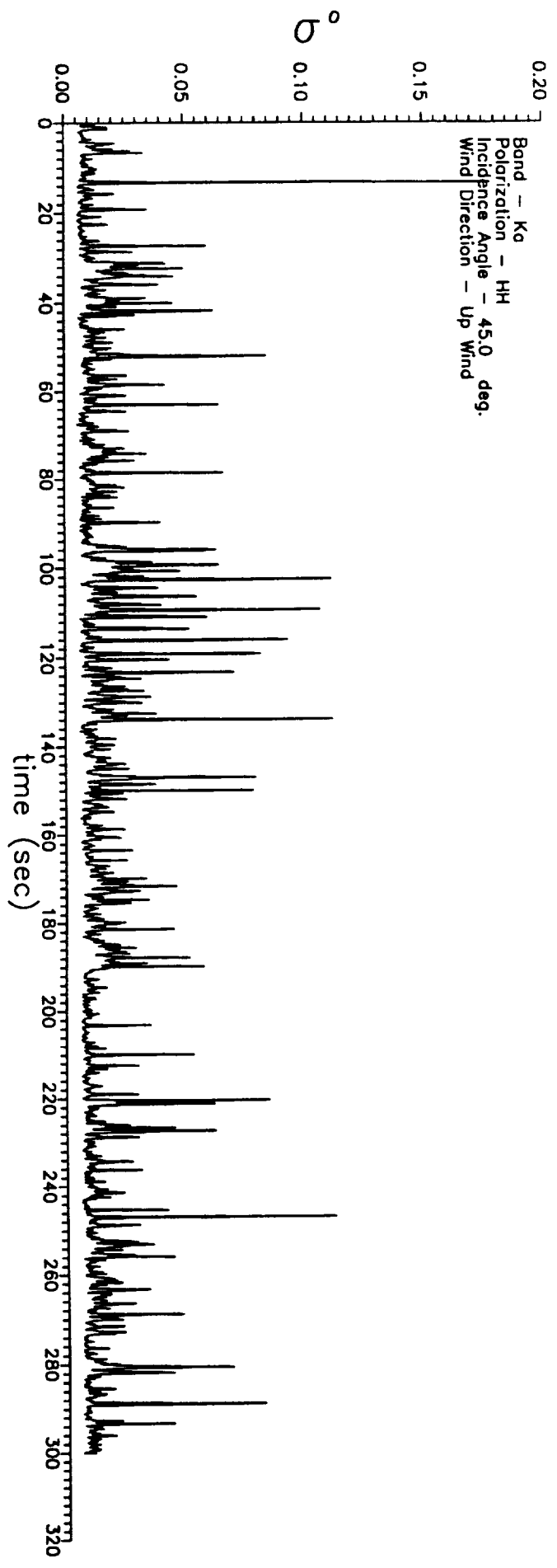


Run 18, 19:04, July 18, 1990



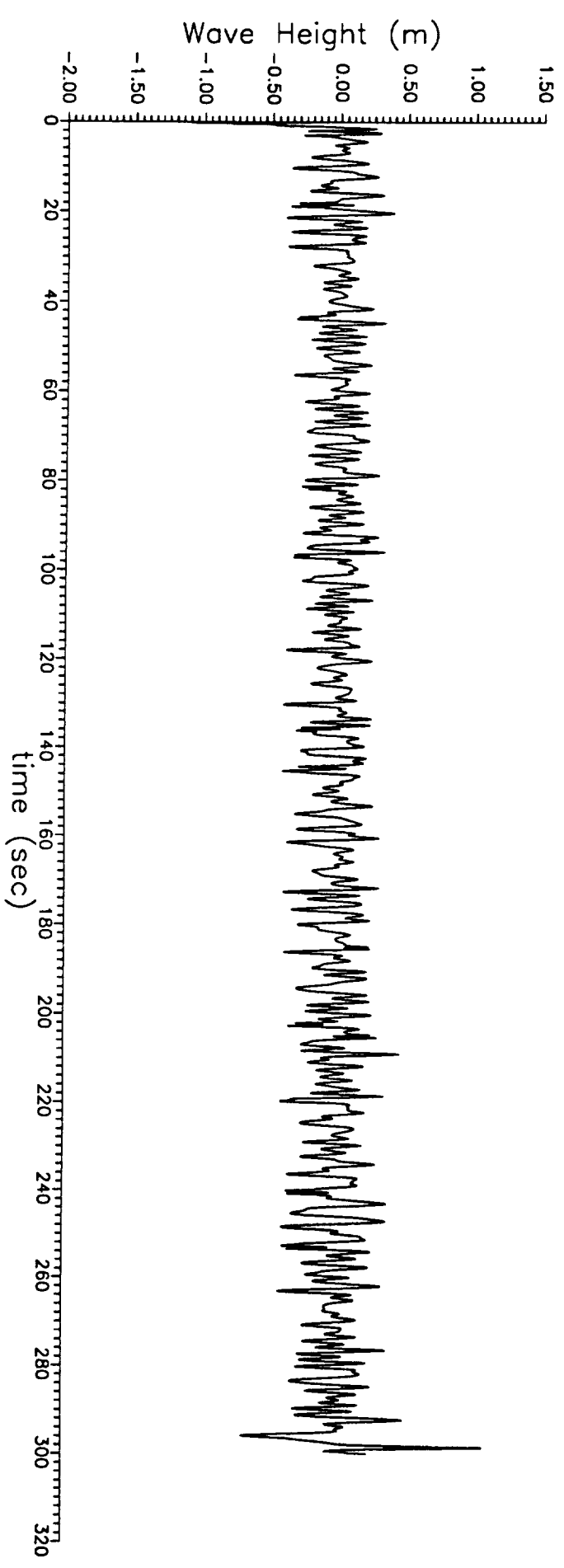
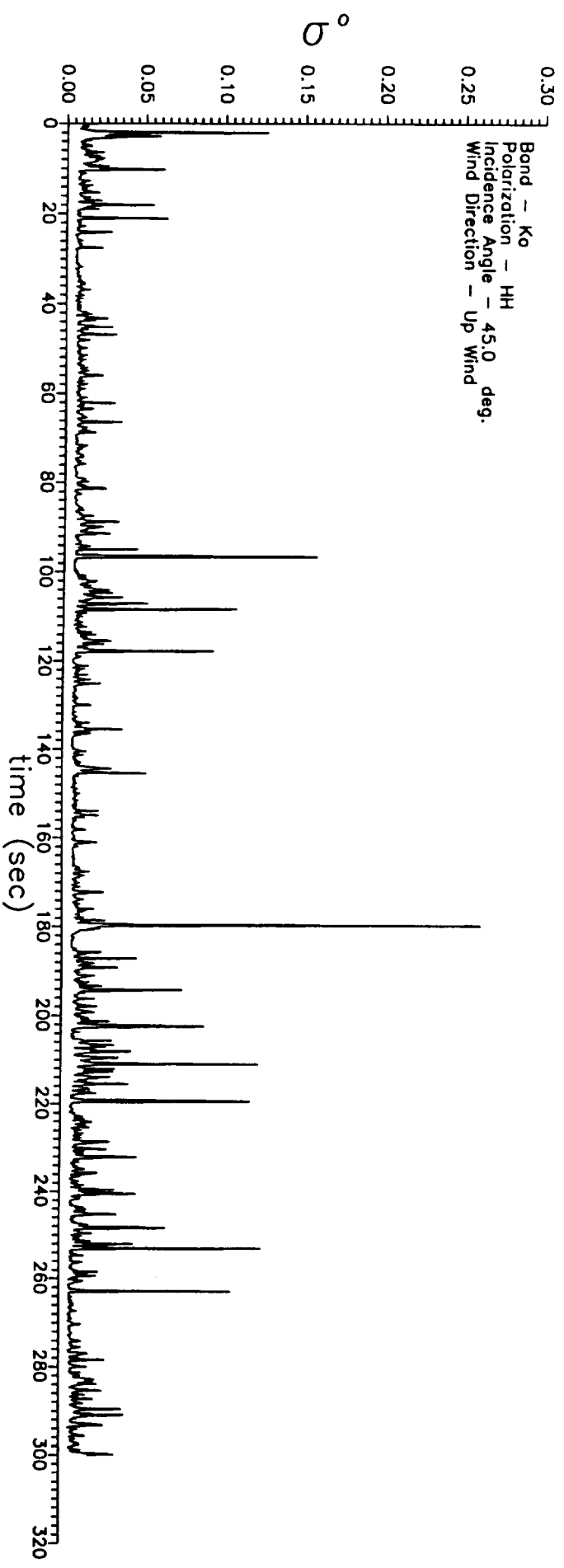
Run 19, 19:11, July 18, 1990

Band - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - up Wind



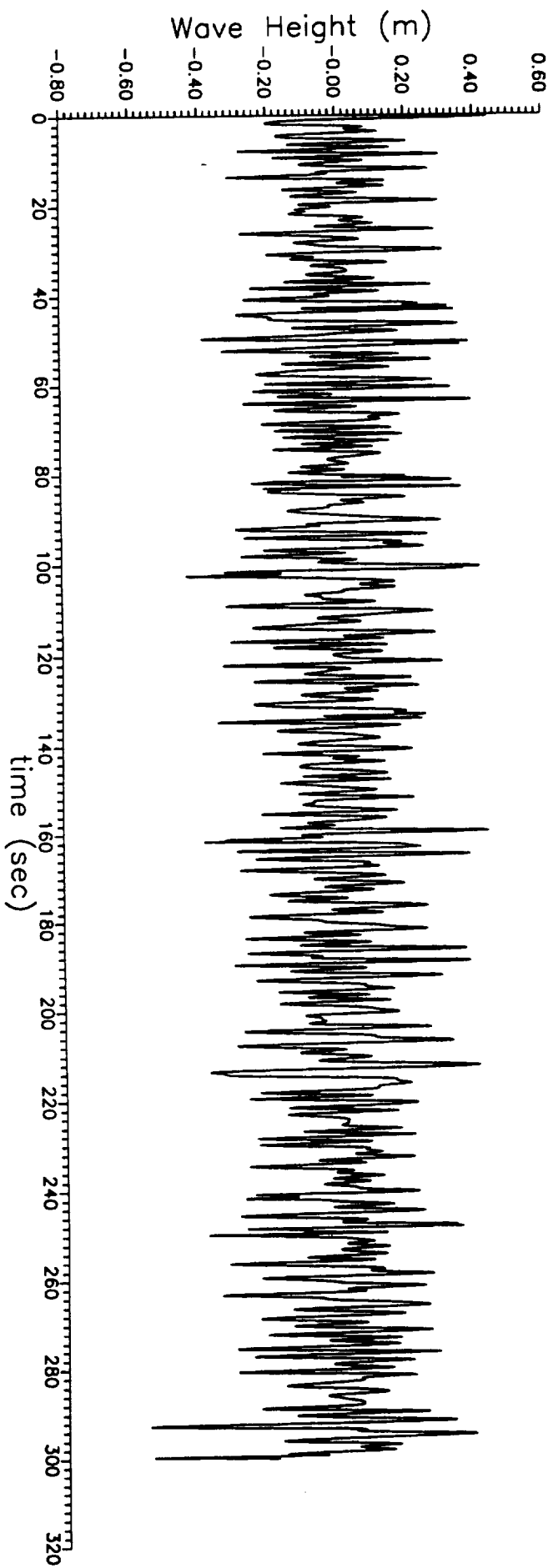
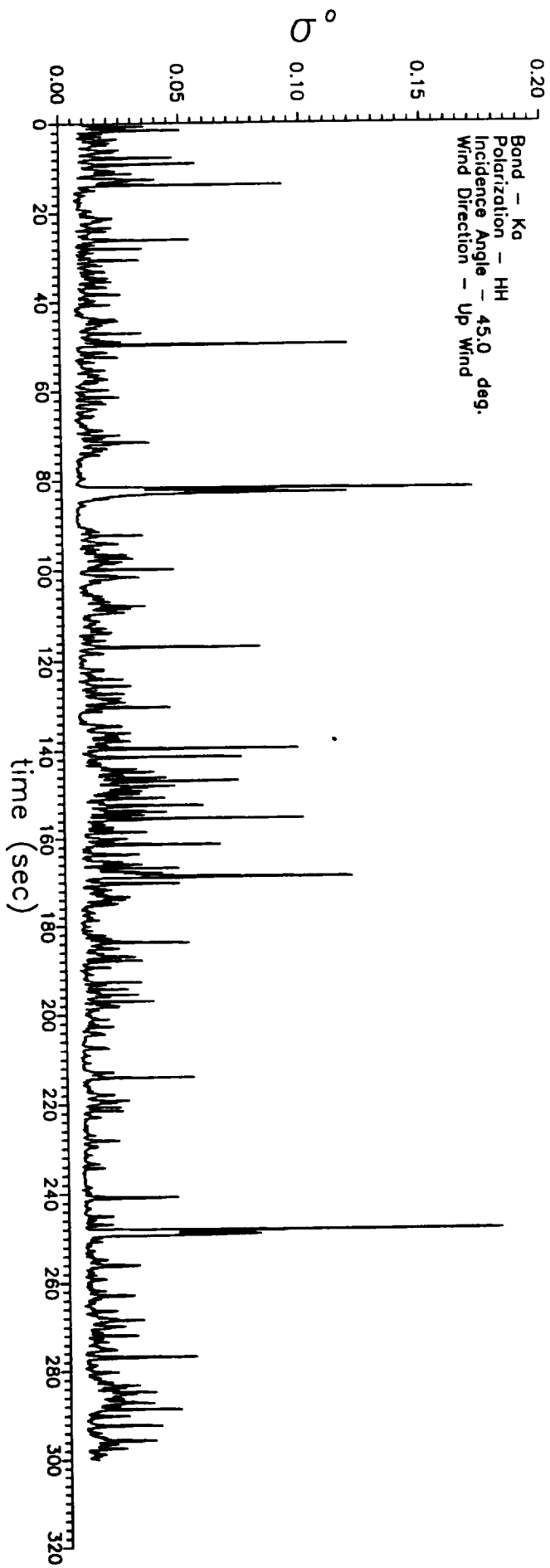
Run 20, 19:17, July 18, 1990

Bond - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

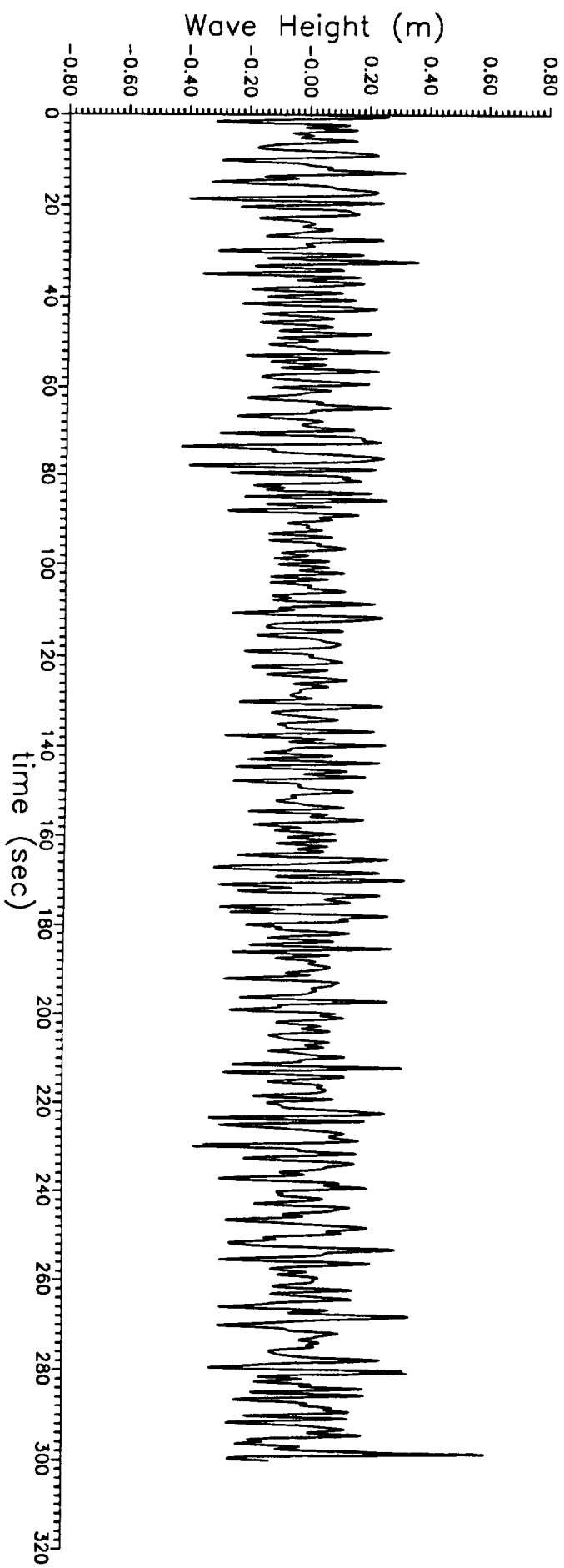
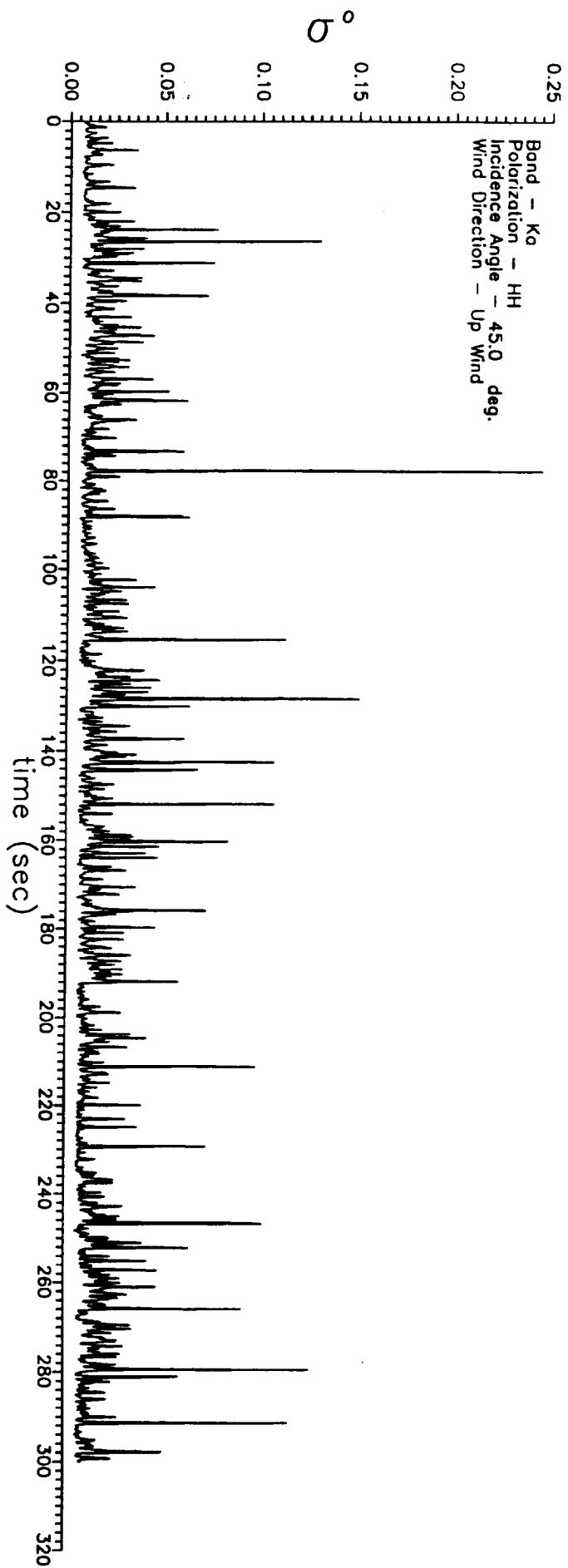


Run 21, 19:23, July 18, 1990

Band - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

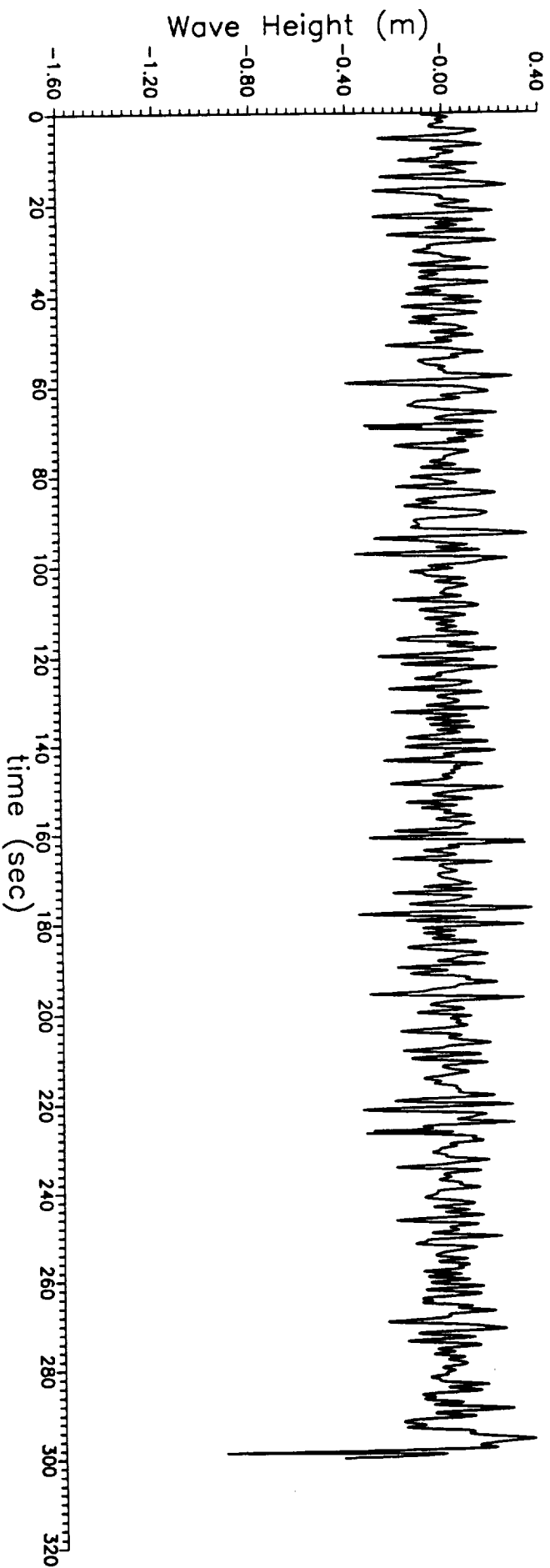
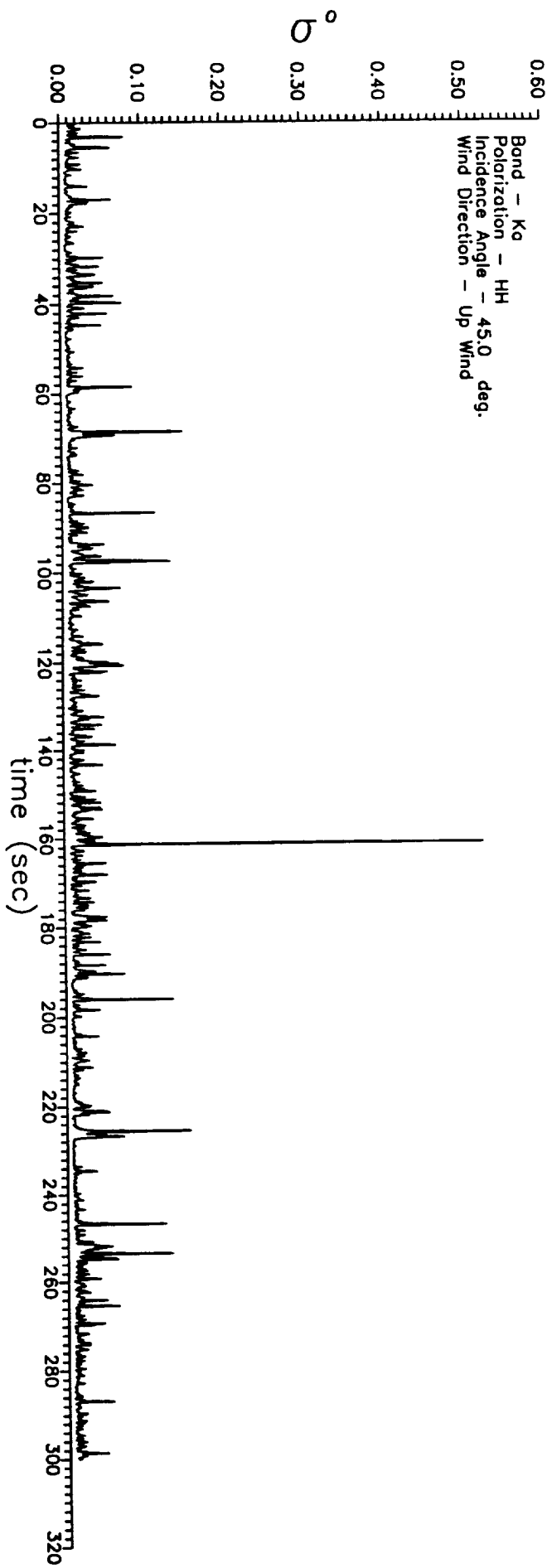


Run 22, 19:29, July 18, 1990

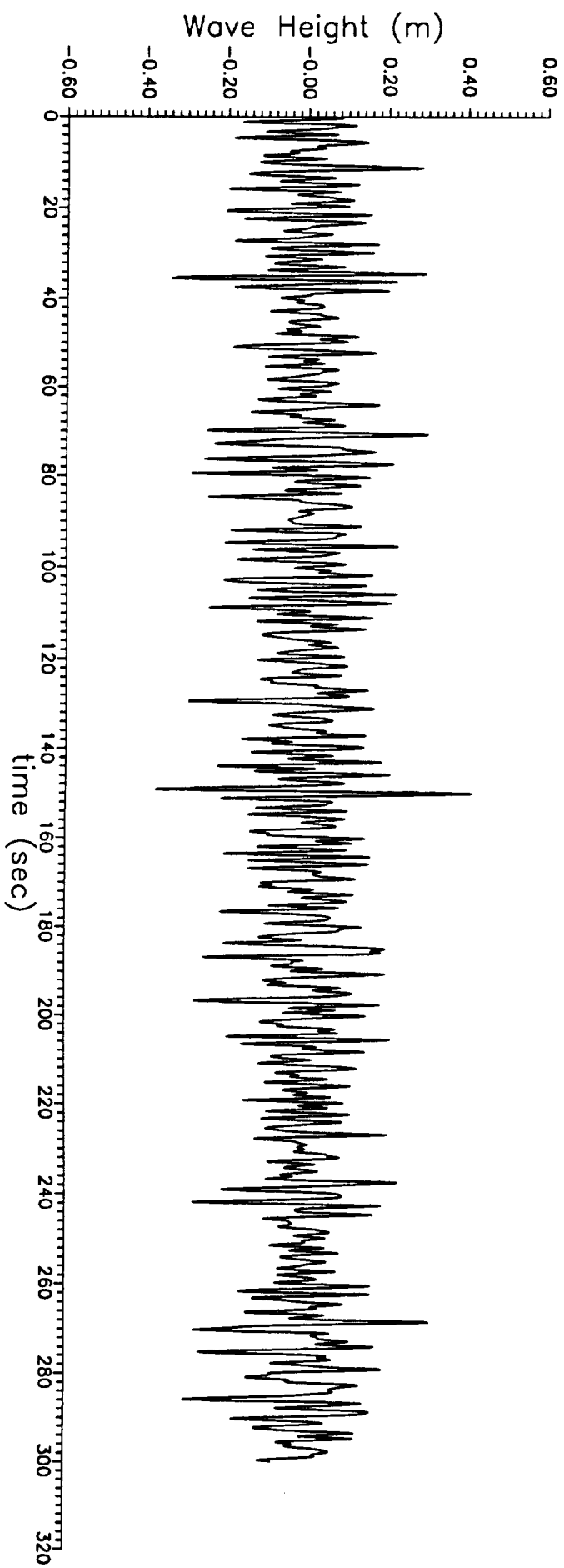
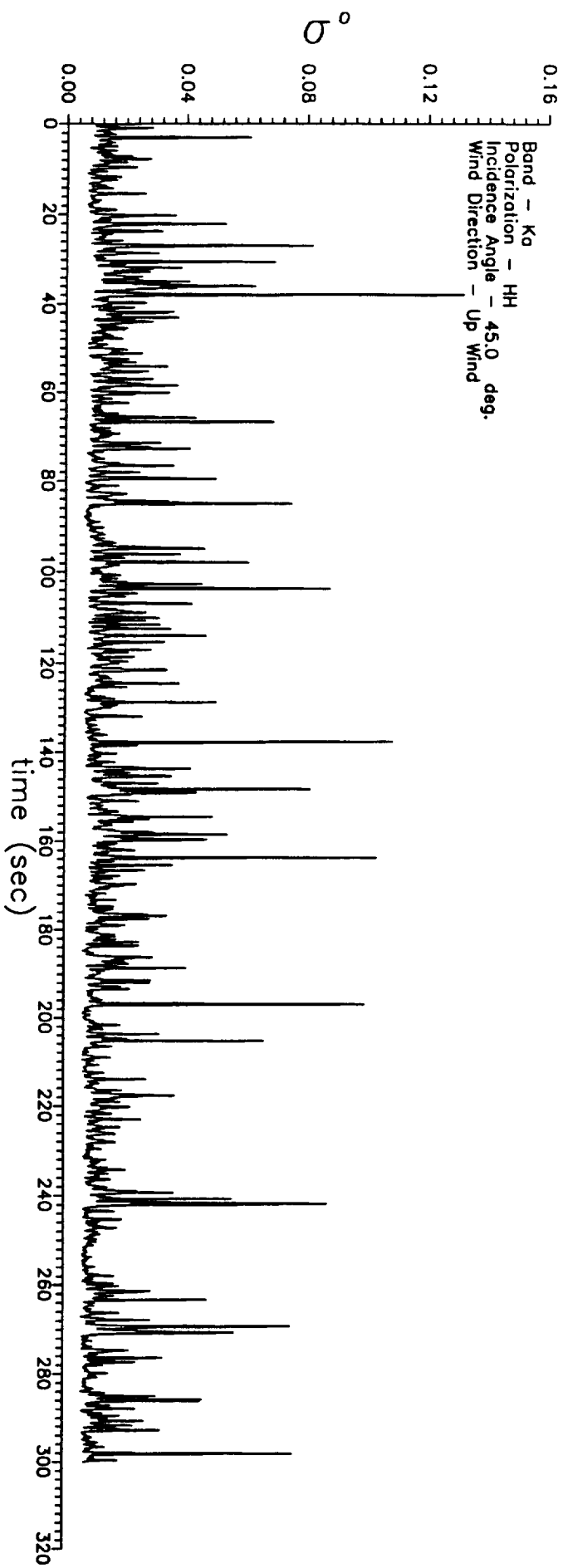


Run 23, 19:47, July 18, 1990

Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

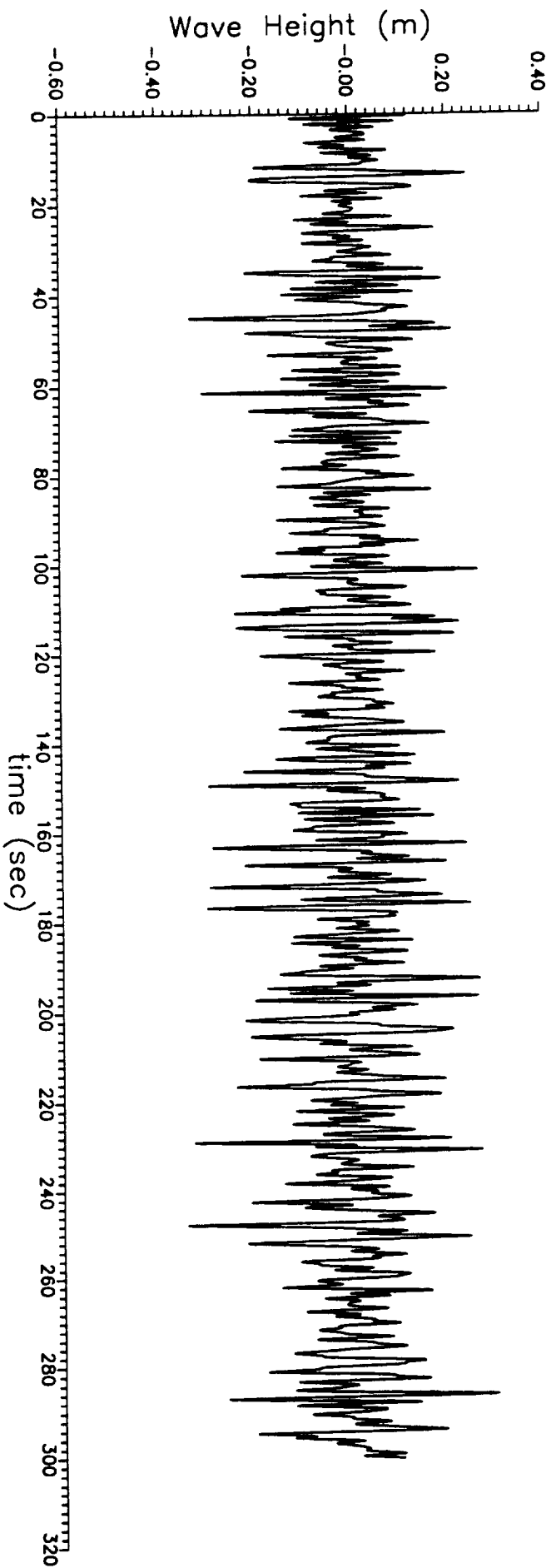
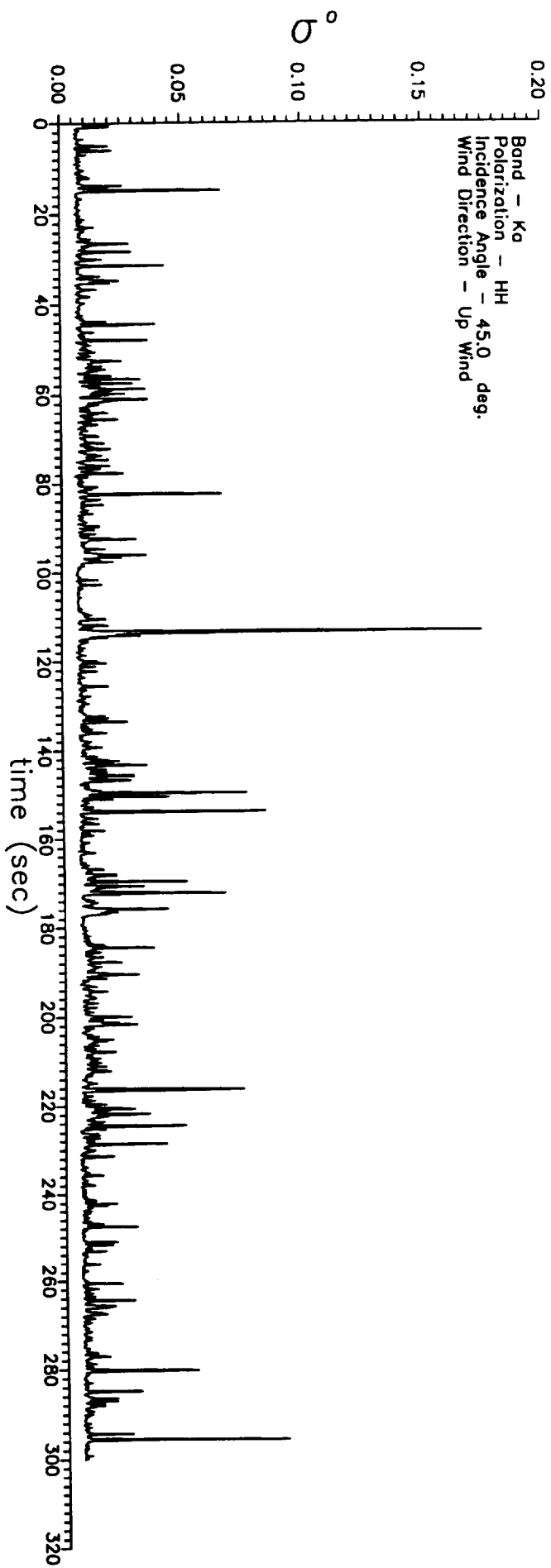


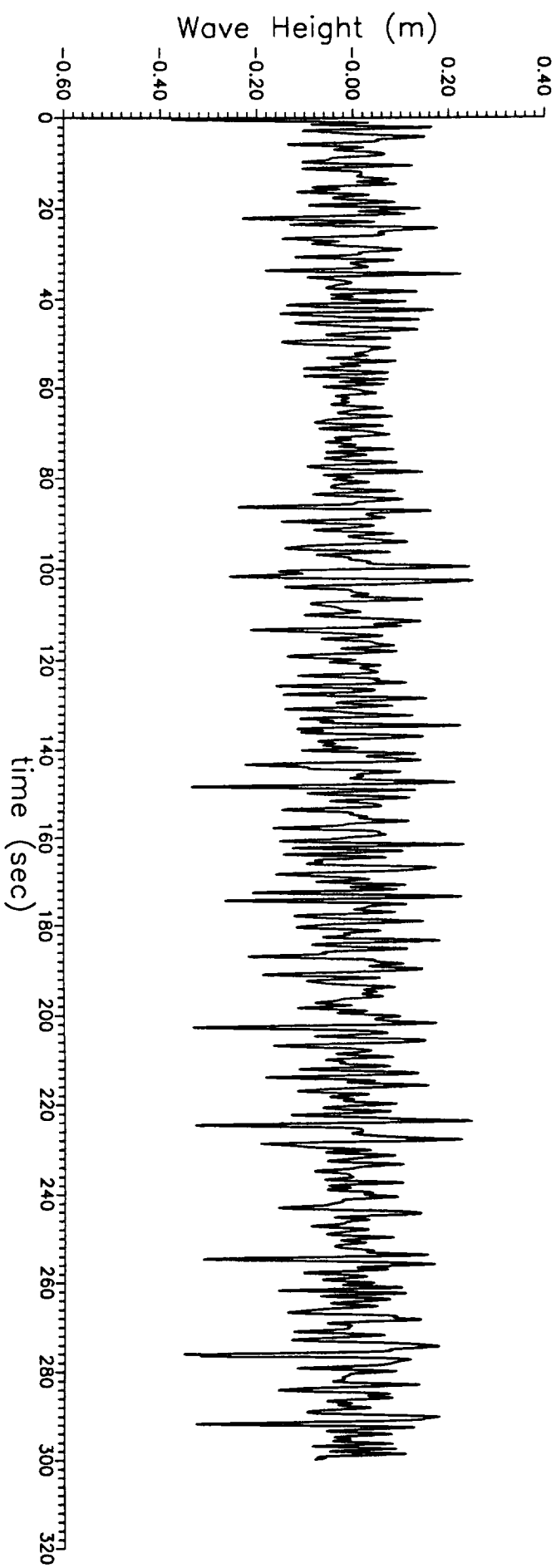
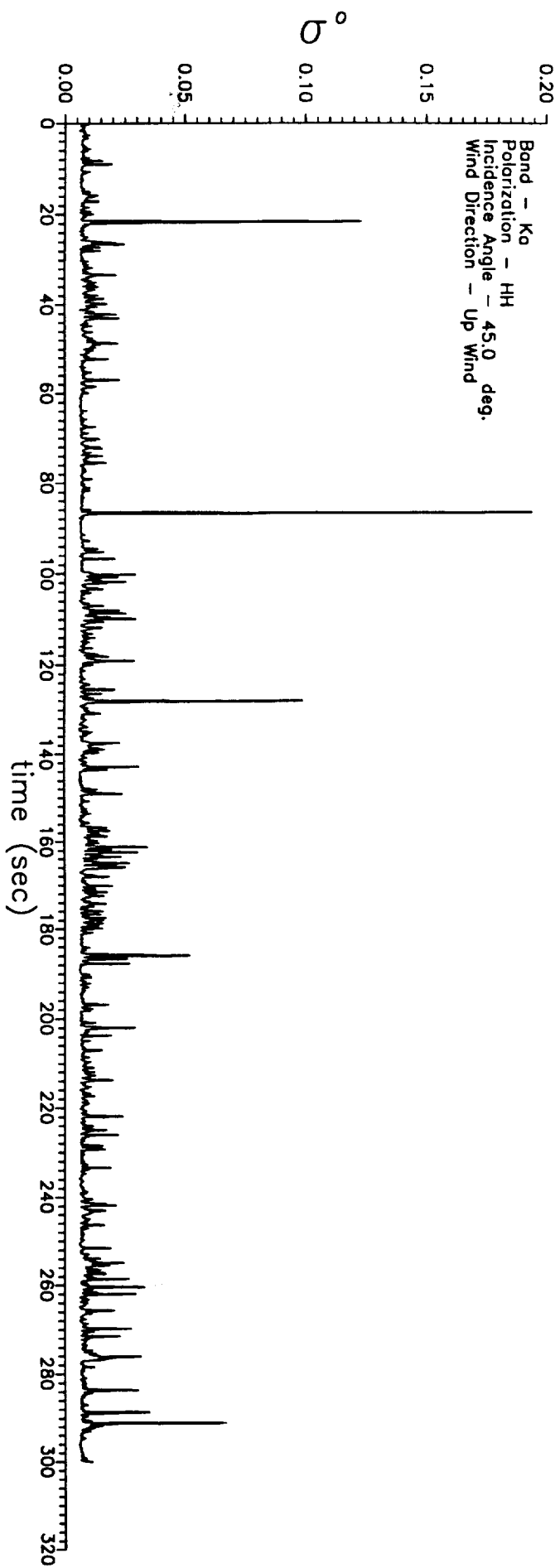
Run 24, 19:53, July 18, 1990



Run 25, 20:02, July 18, 1990

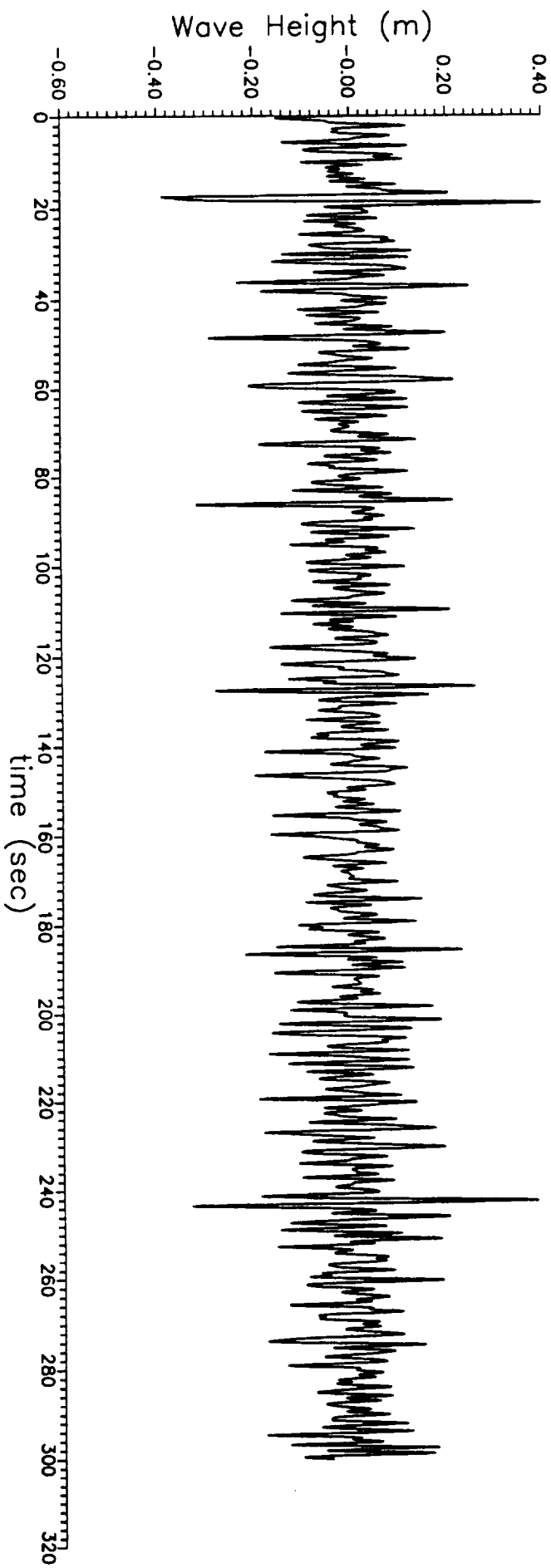
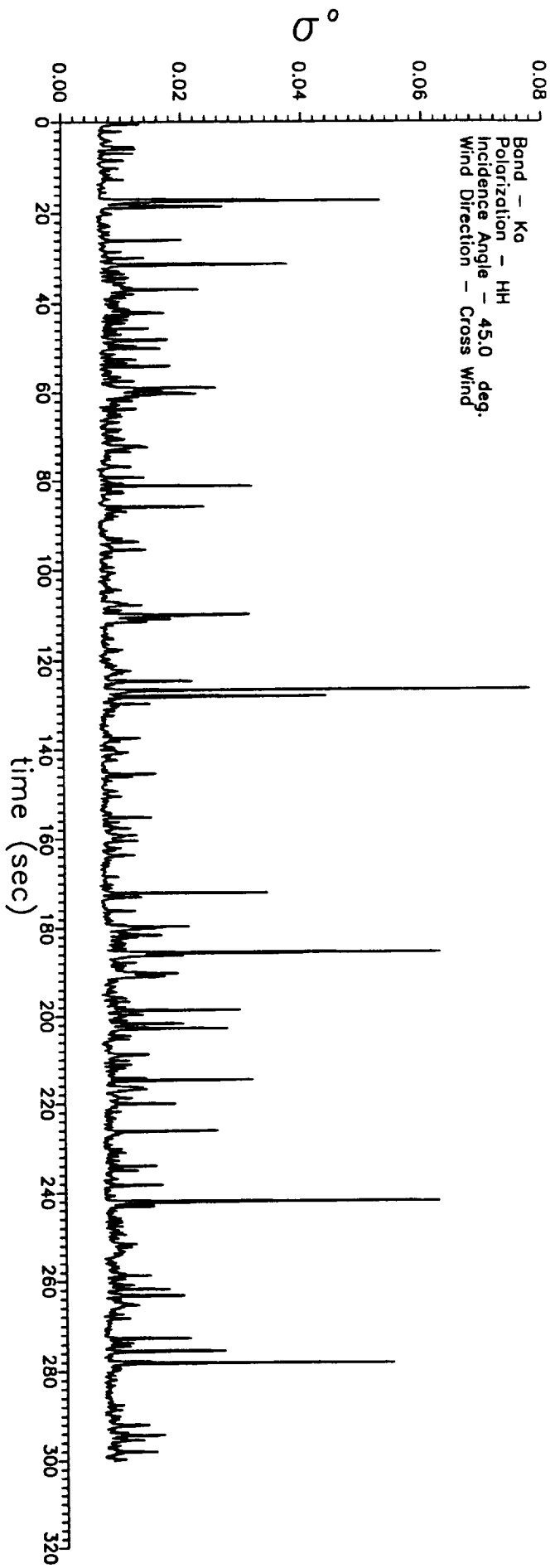
Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind





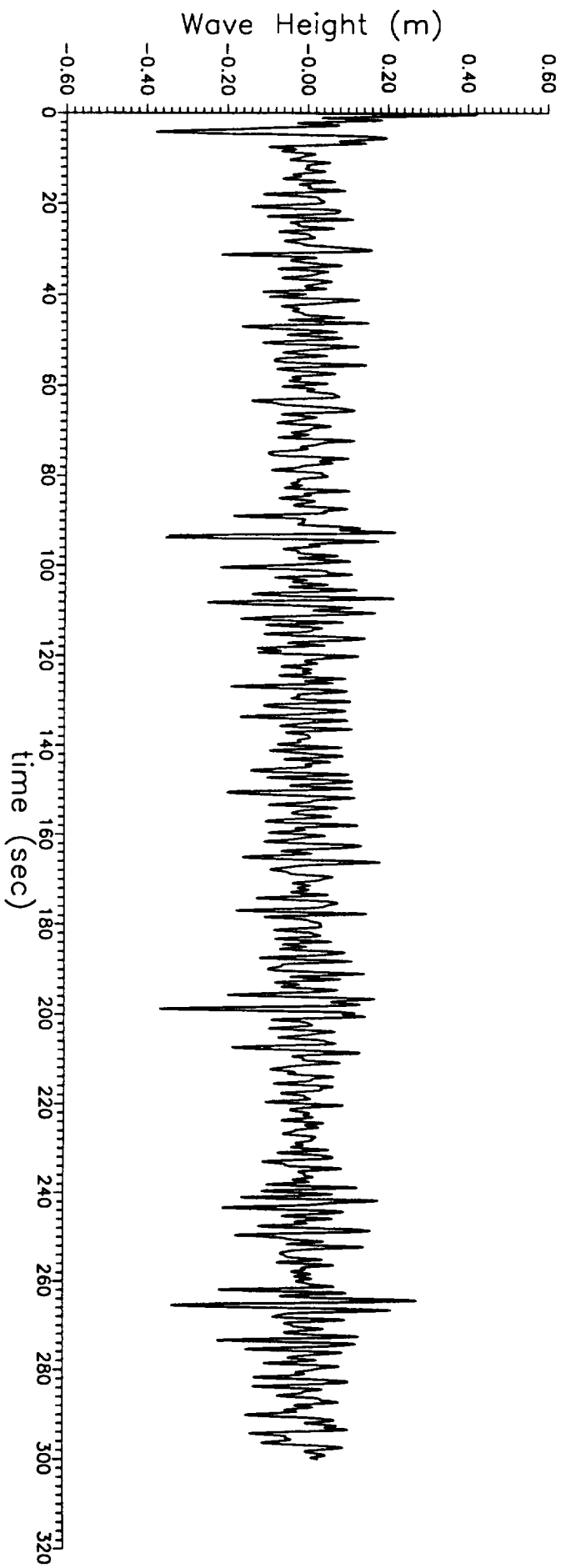
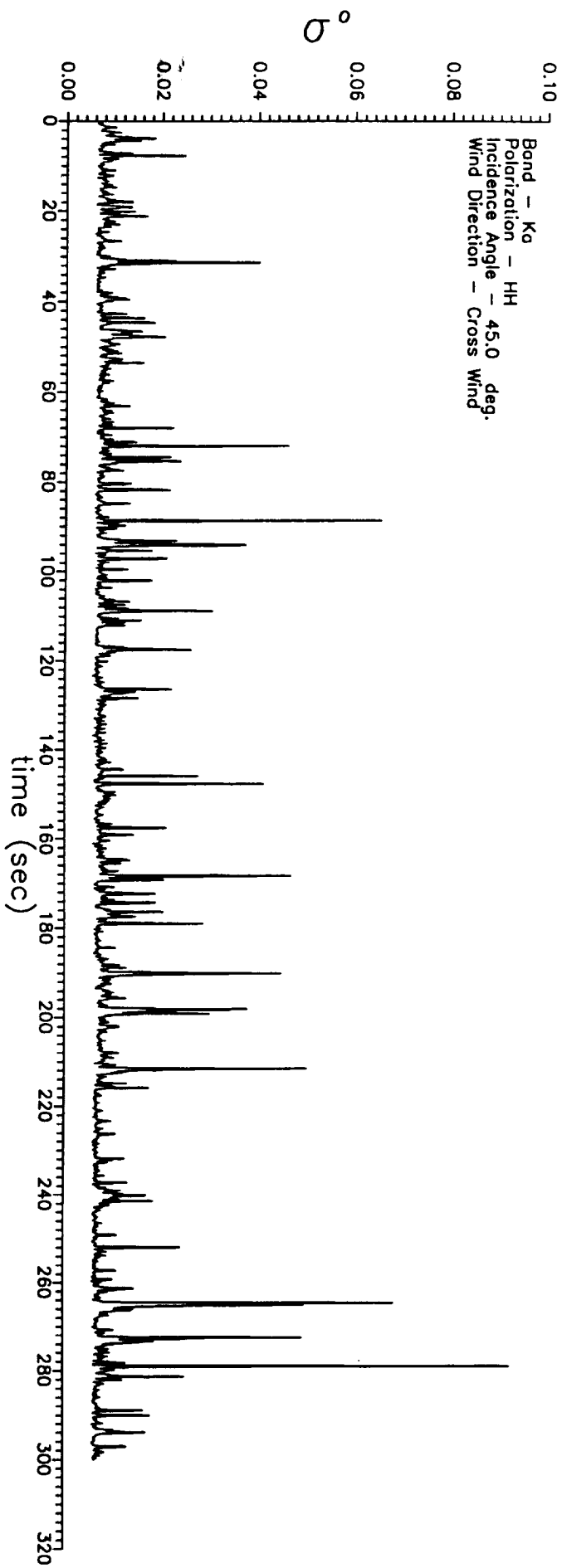
Run 27, 20:14, July 18, 1990

Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind

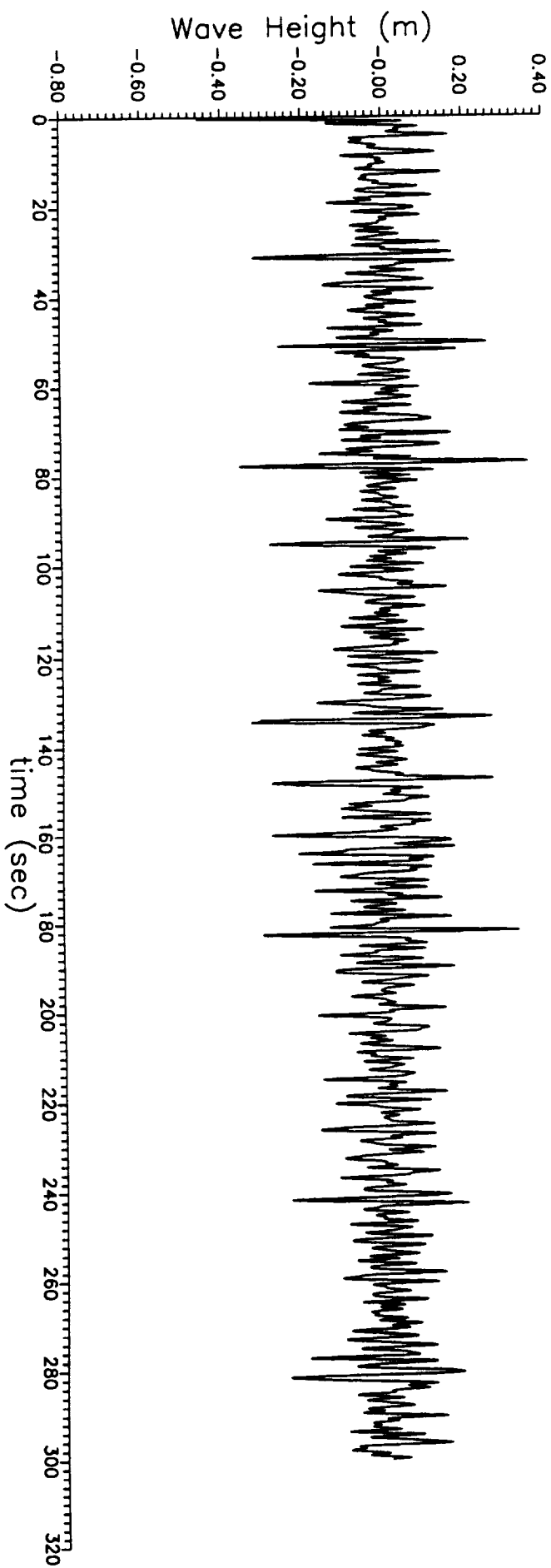
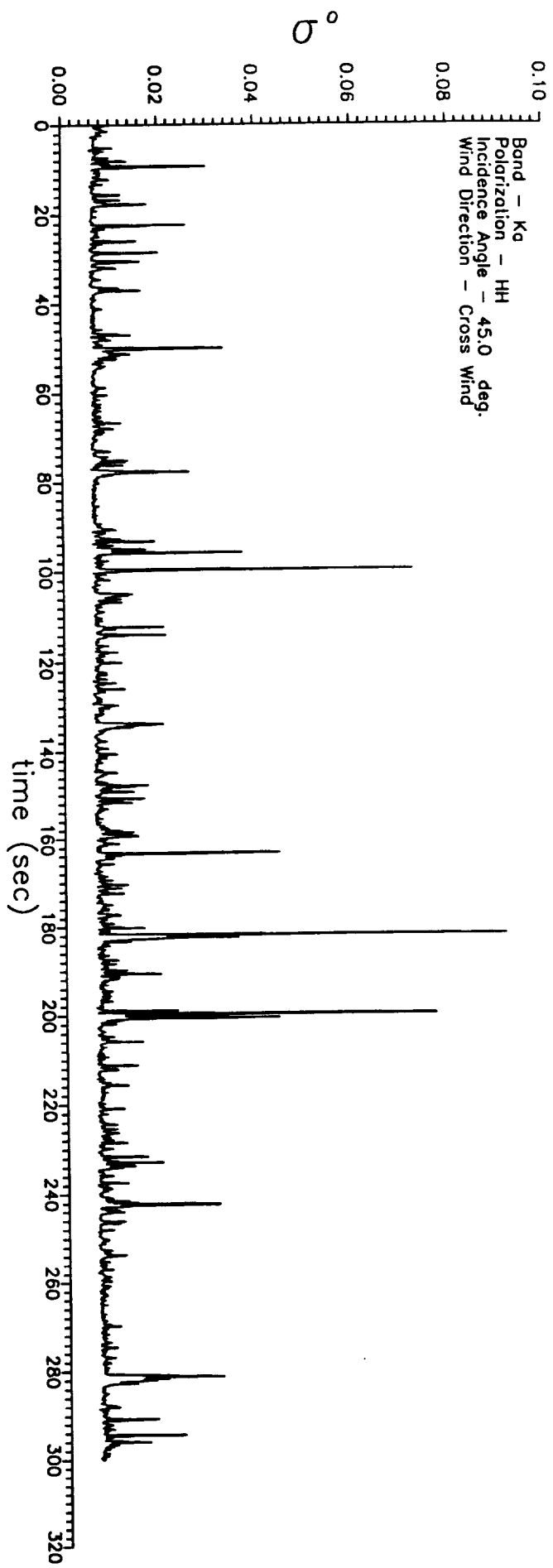


Run 28, 20:20, July 18, 1990

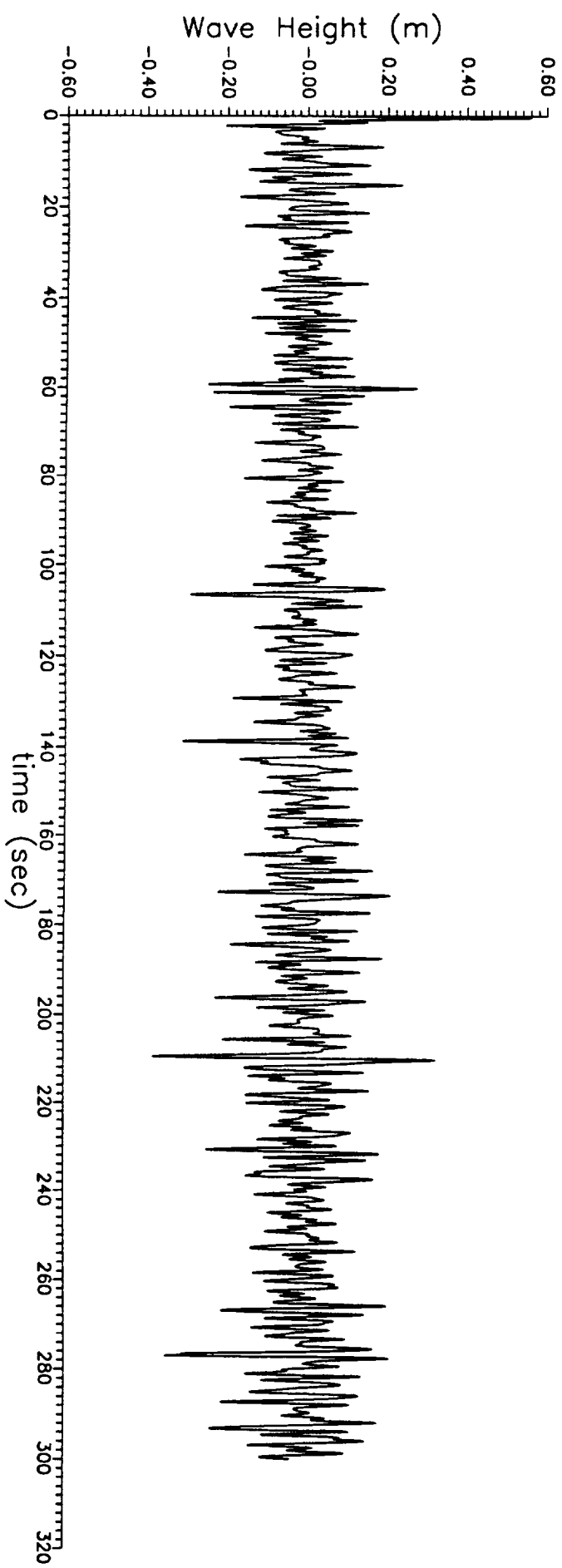
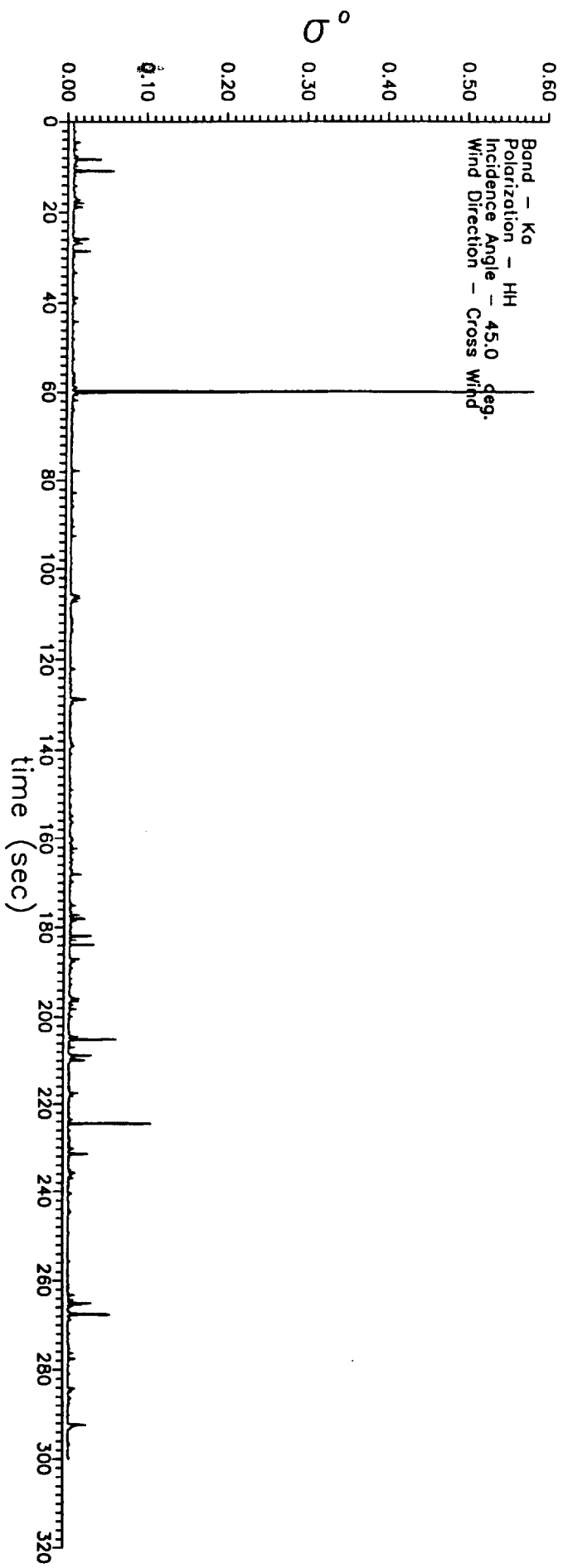
Band - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind



Run 29, 20:26, July 18, 1990

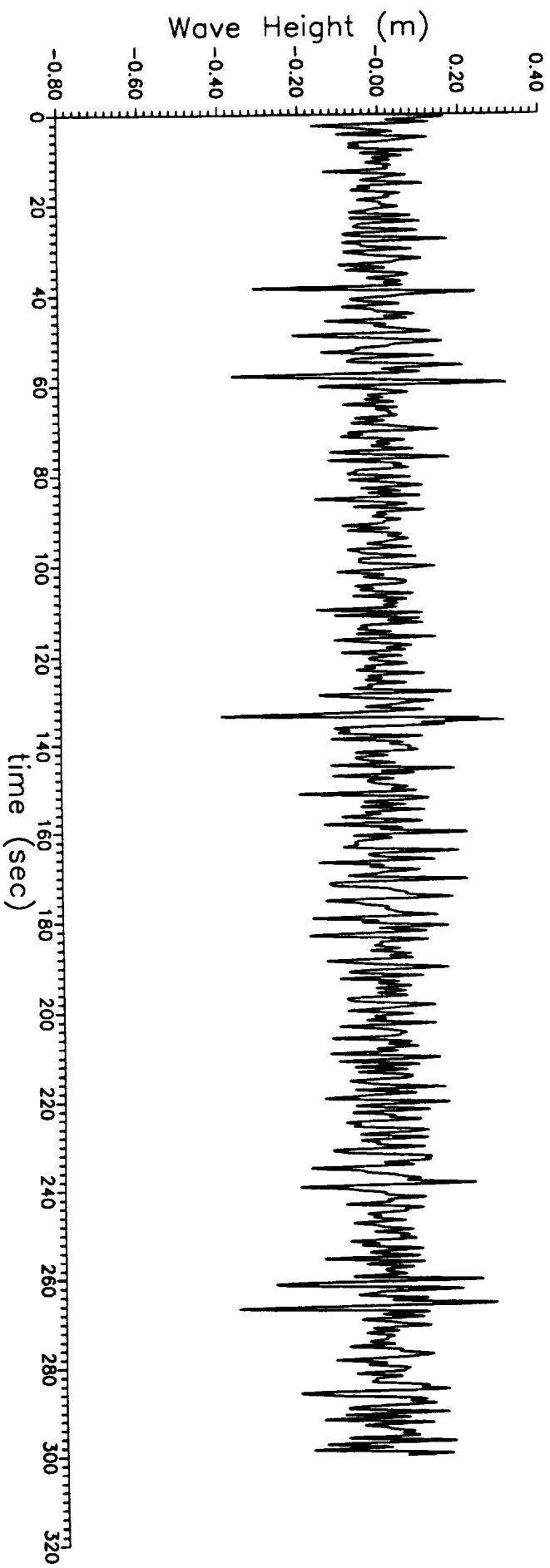
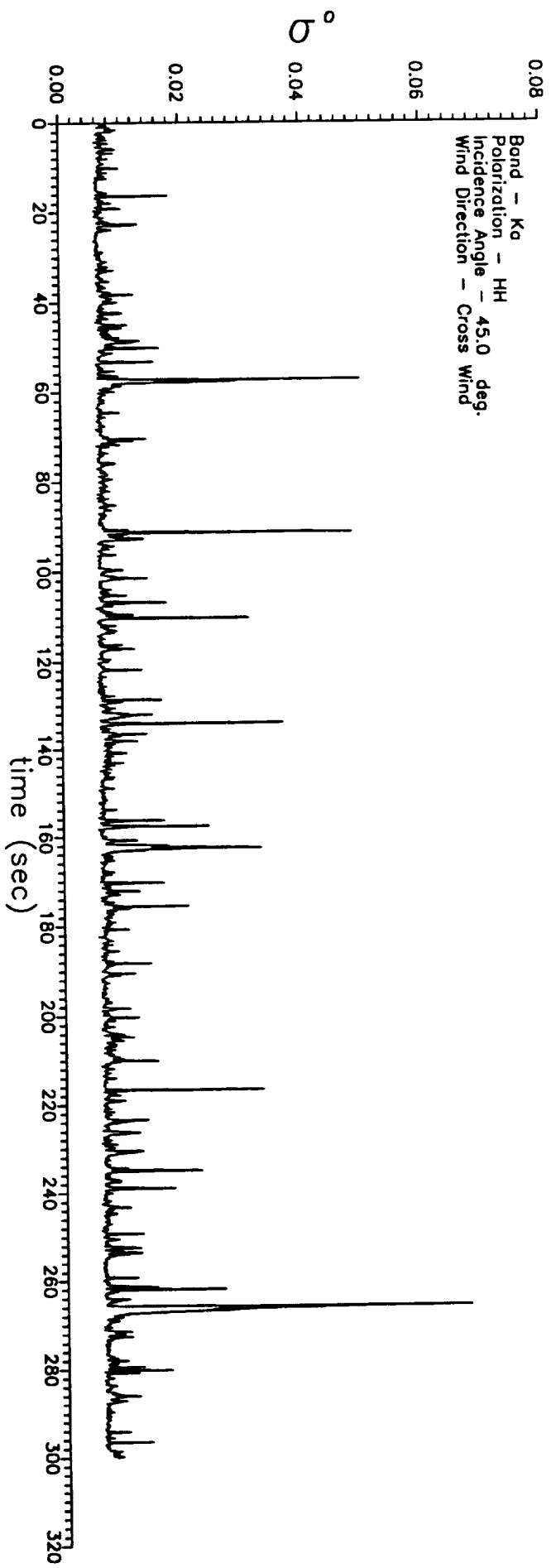


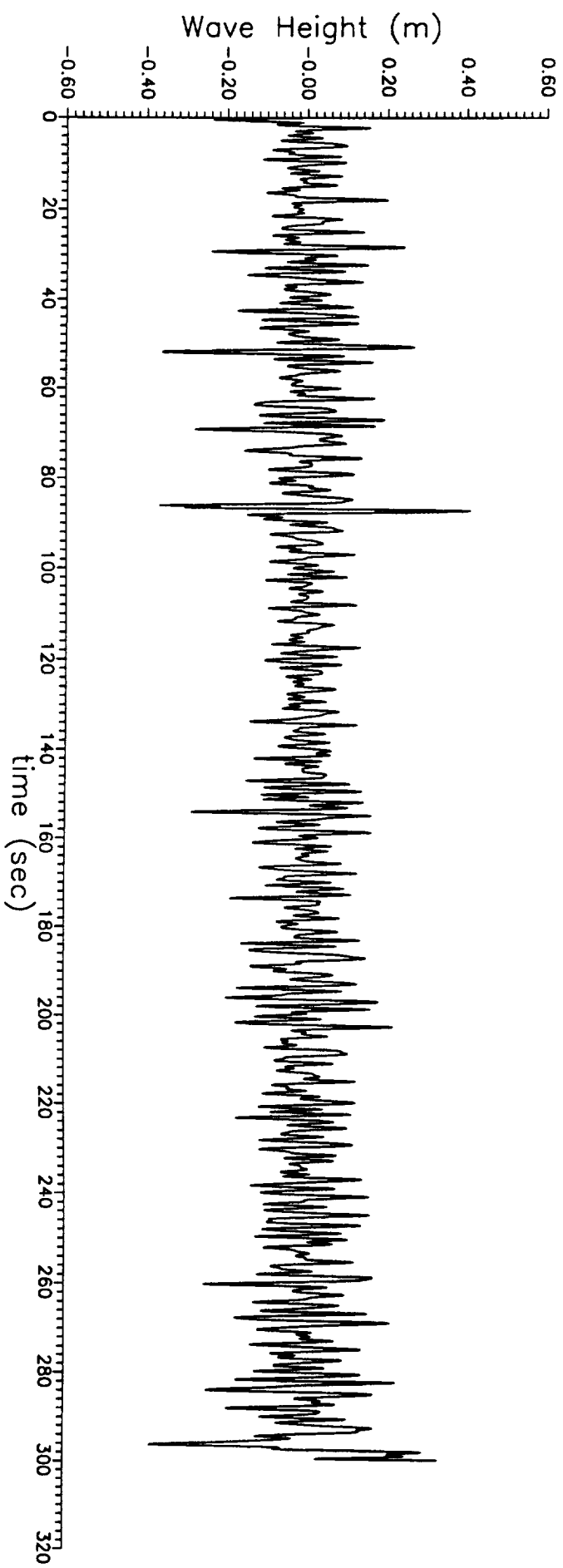
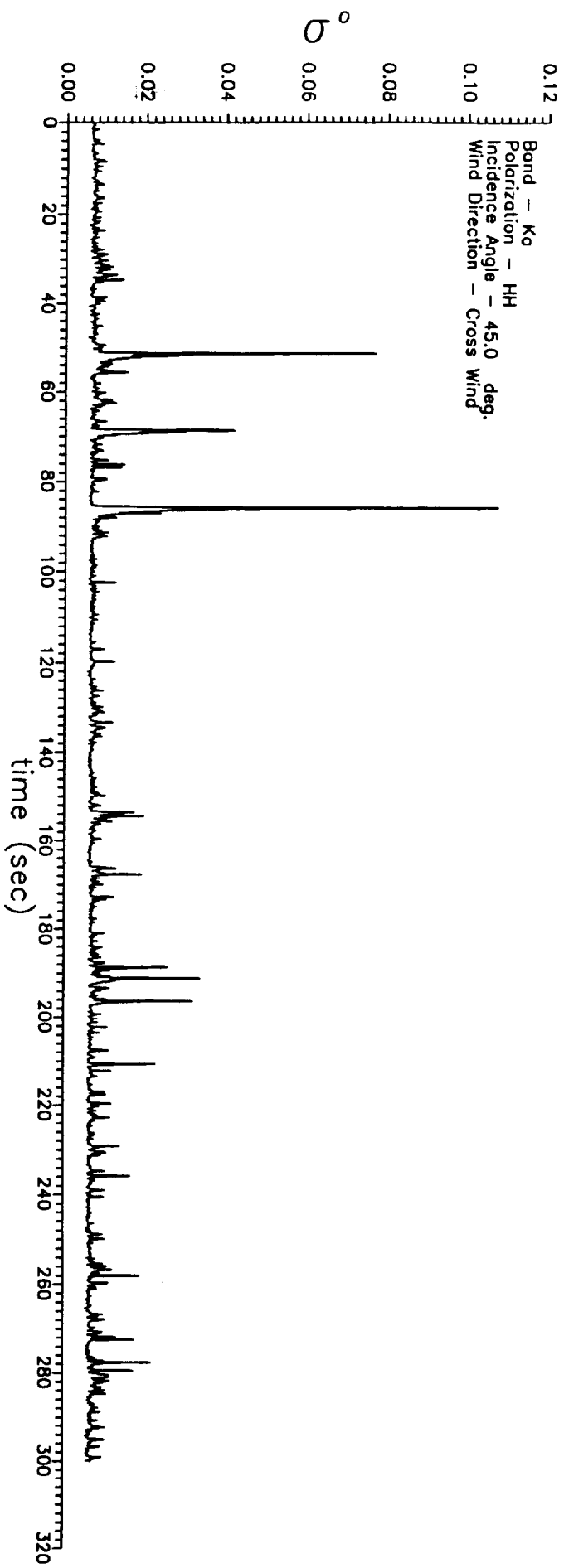
Run 30, 20:32, July 18, 1990



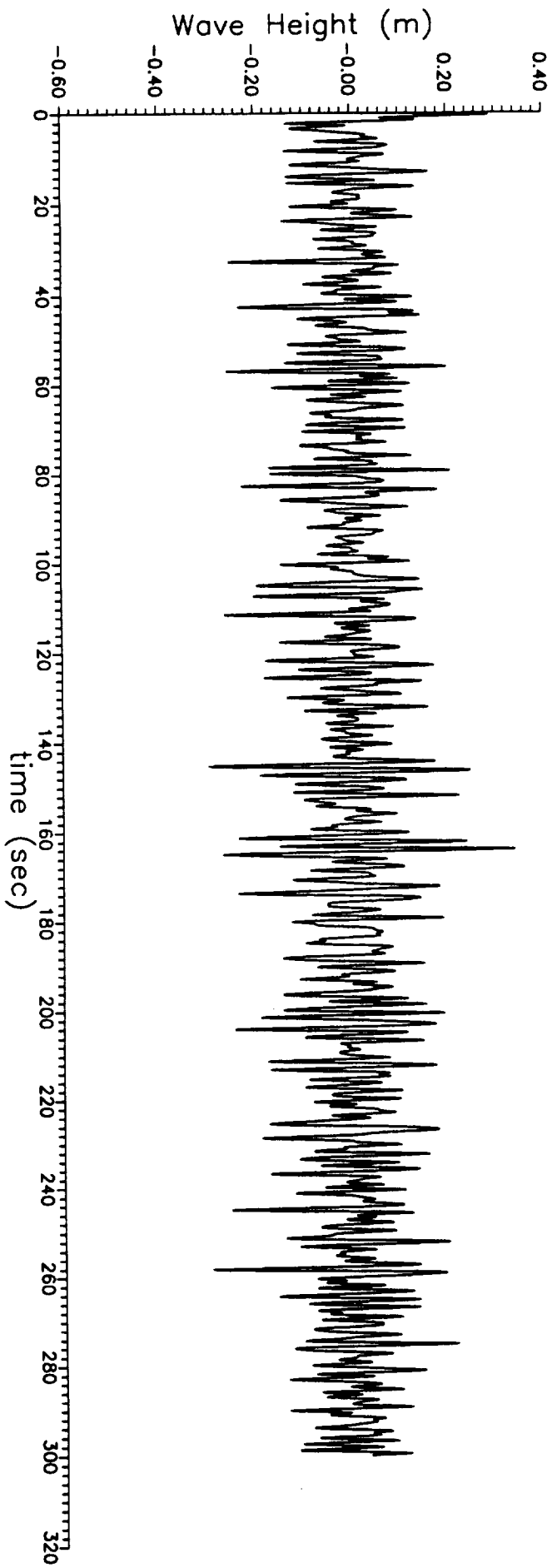
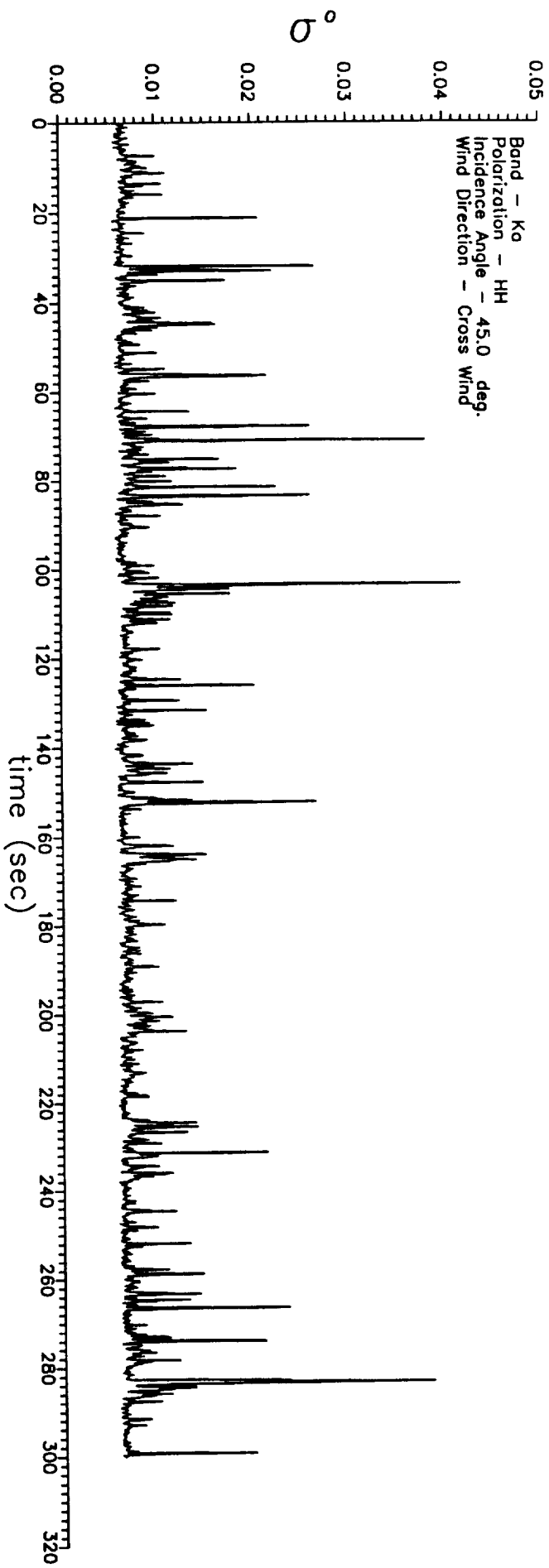
Run 31, 20:37, July 18, 1990

Band - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind





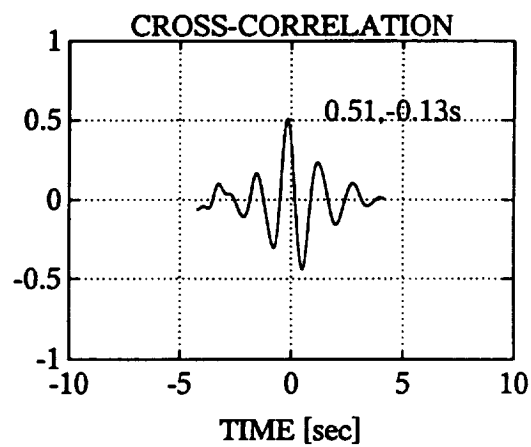
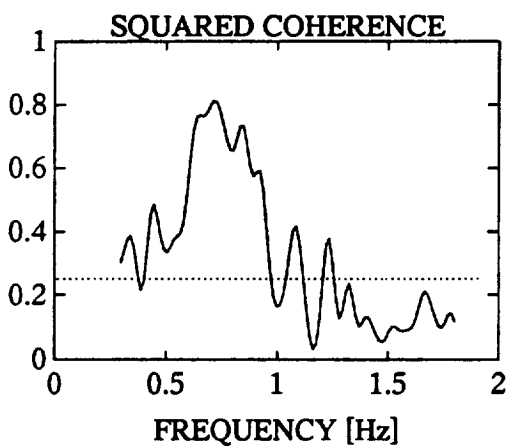
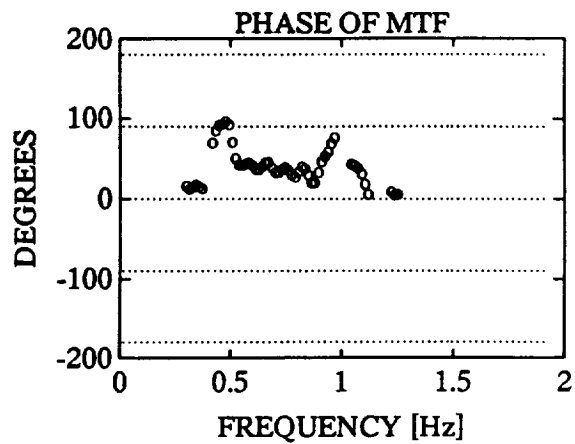
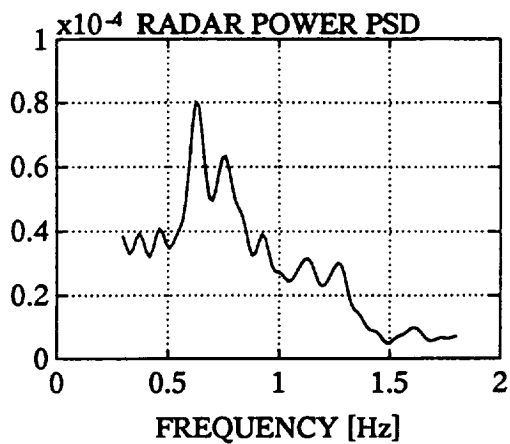
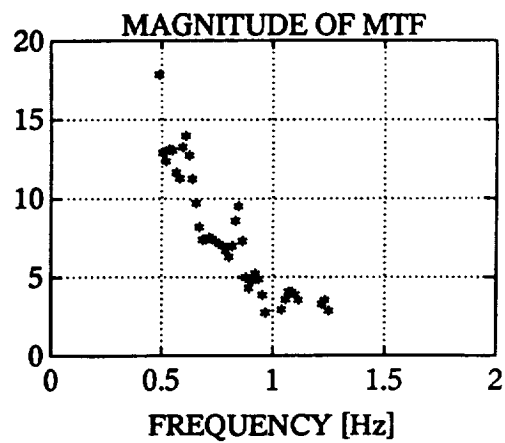
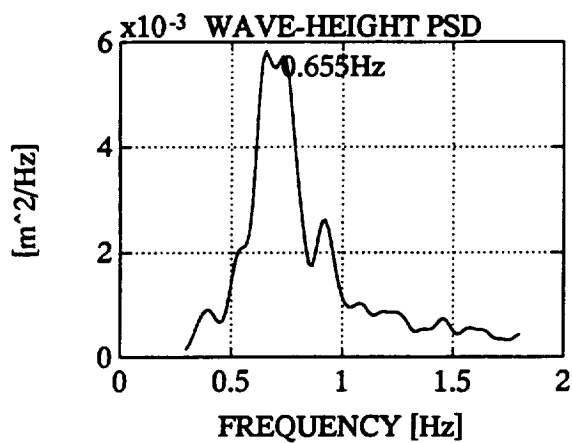
Run 33, 20:49, July 18, 1990



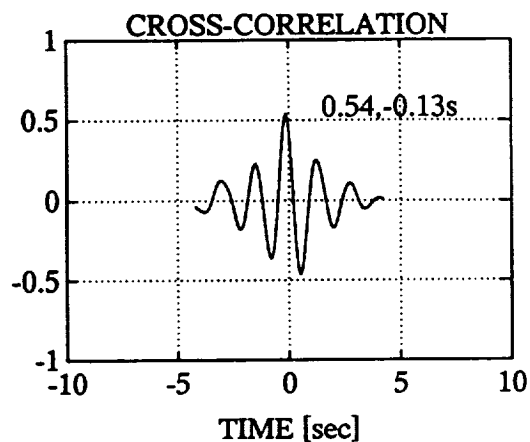
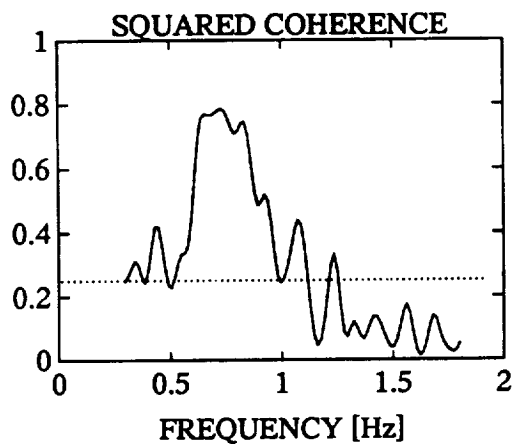
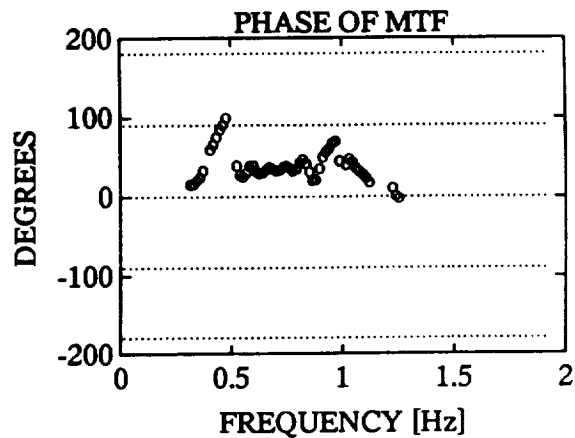
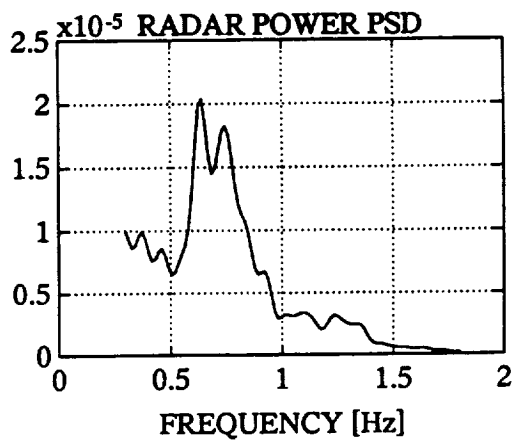
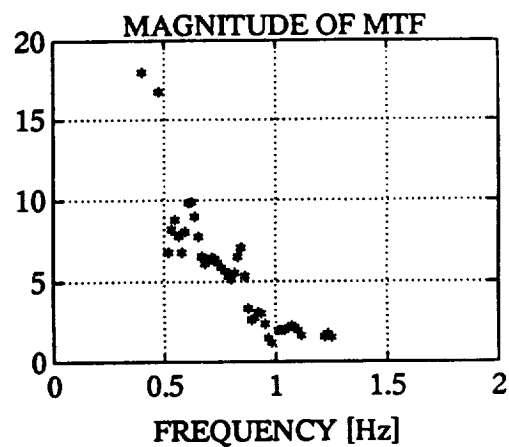
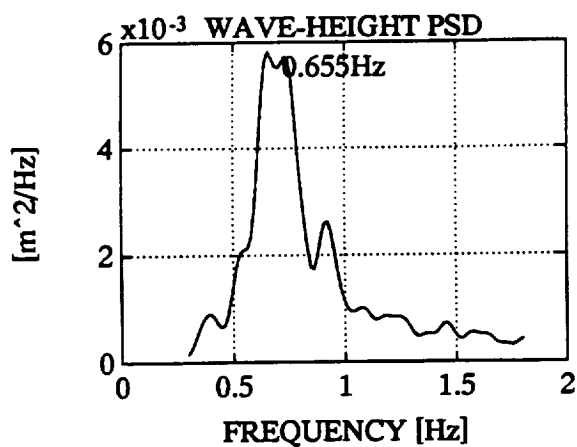
Appendix C

Plots of PSD, MTF, Coherence Function and Cross-Correlation Function for Wave Height and Radar Return Power

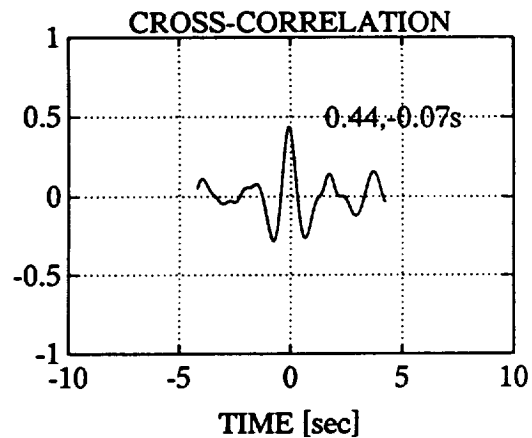
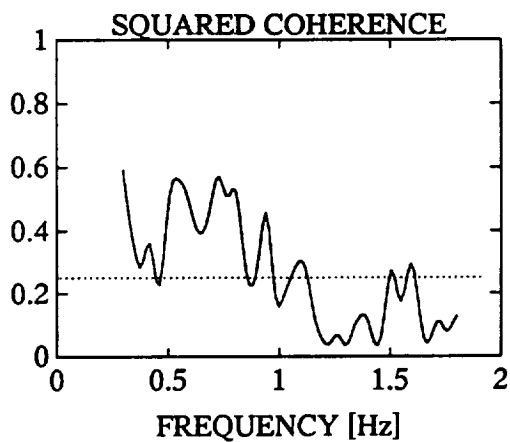
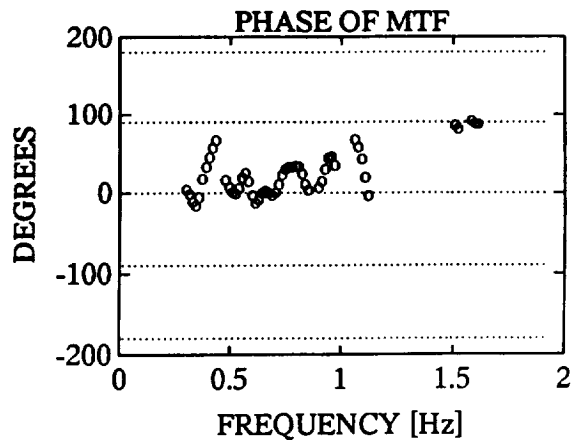
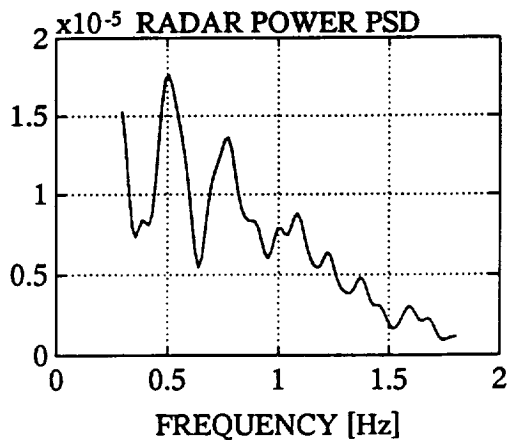
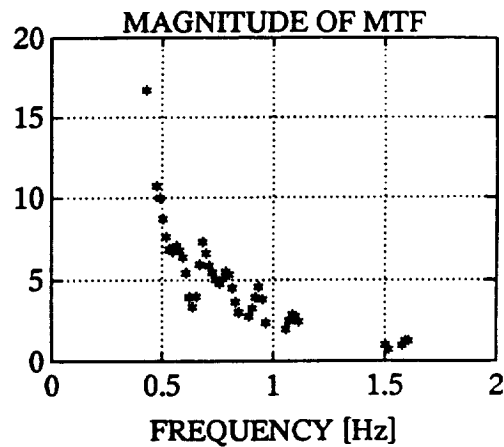
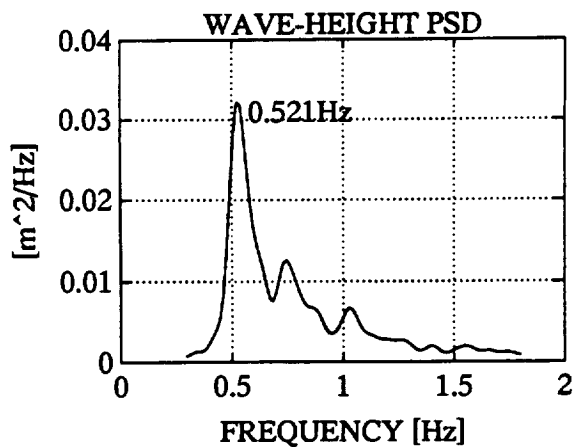
C—1. C Band



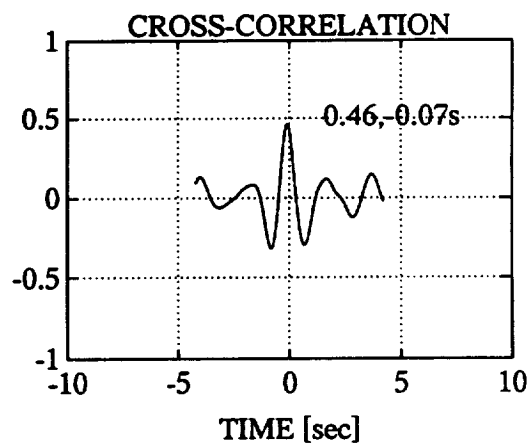
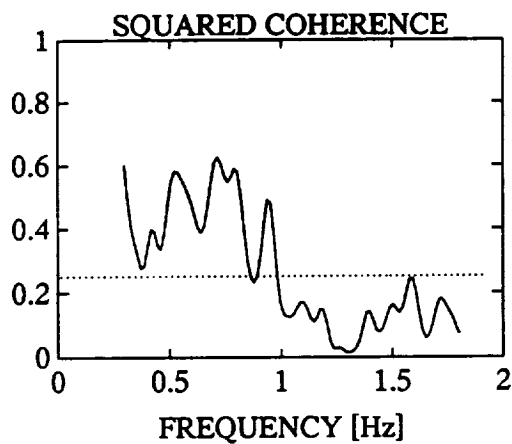
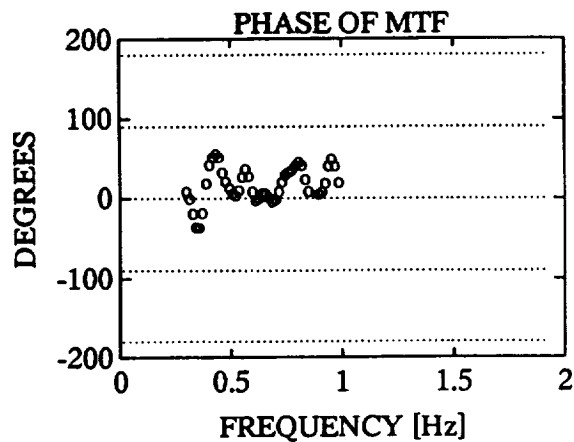
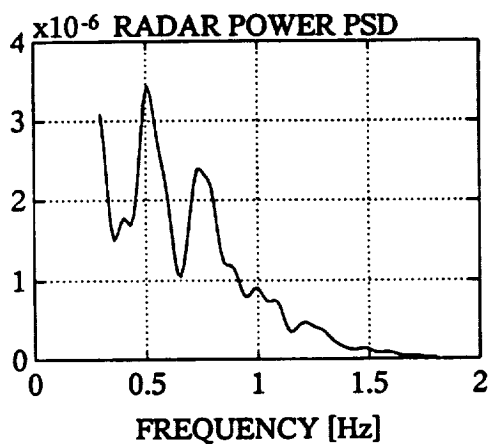
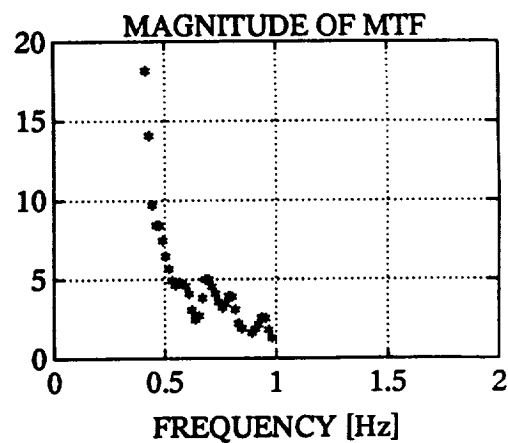
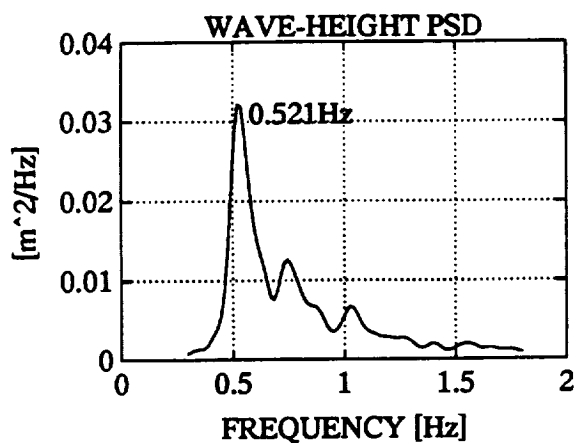
July 19, 1989, Run Time : 17:13:10, Run # 7, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 5.89 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



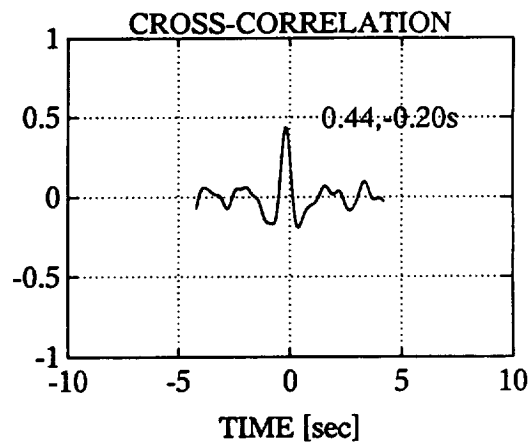
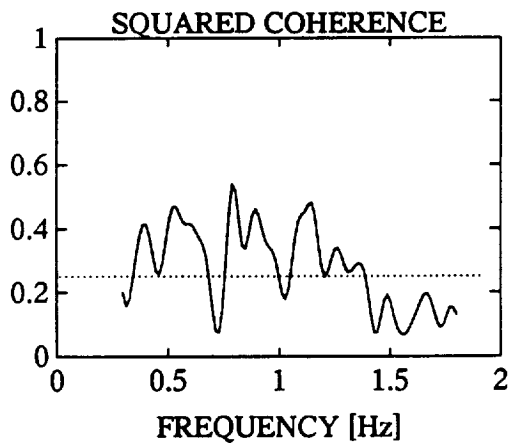
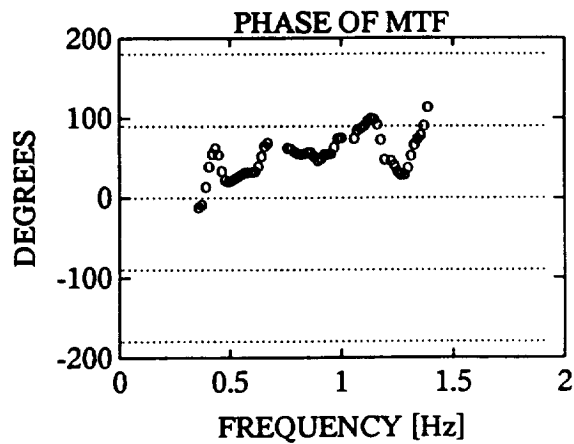
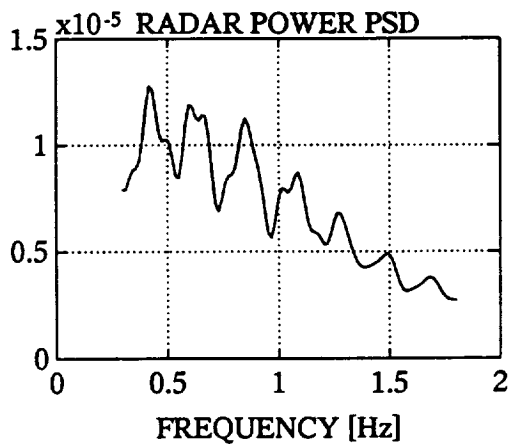
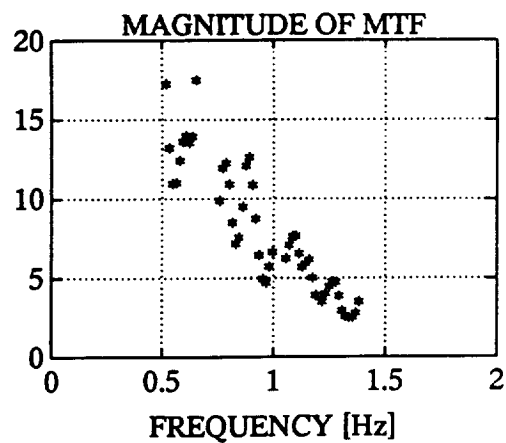
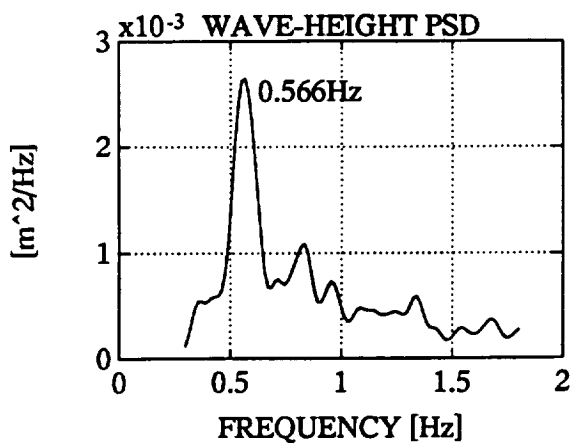
July 19, 1989, Run Time : 17:13:10, Run # 7, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 5.89 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



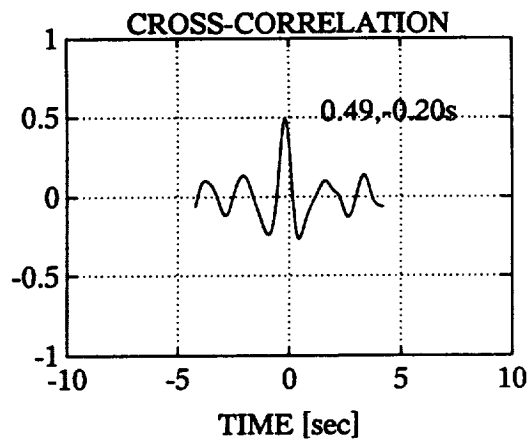
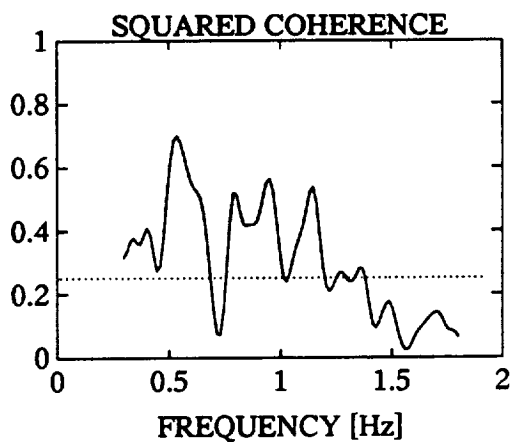
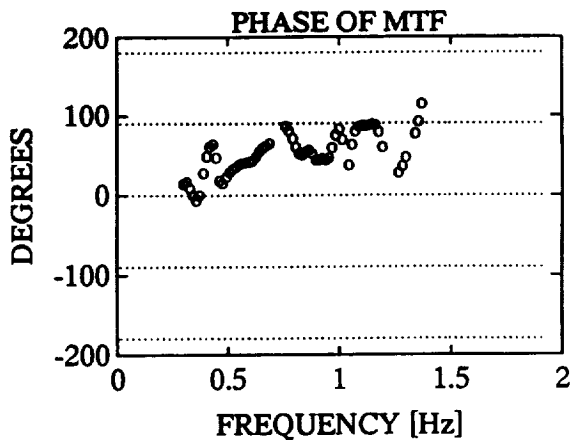
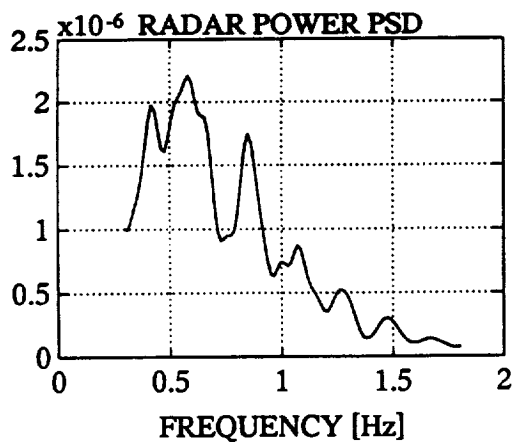
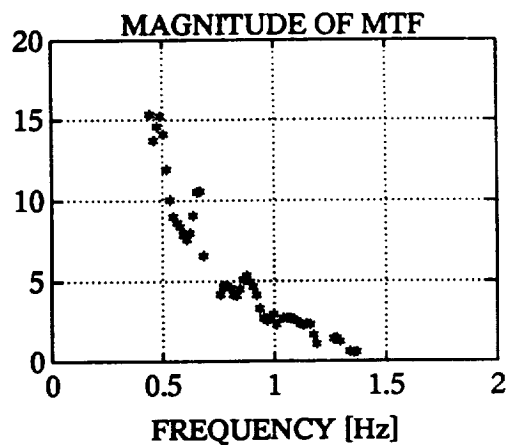
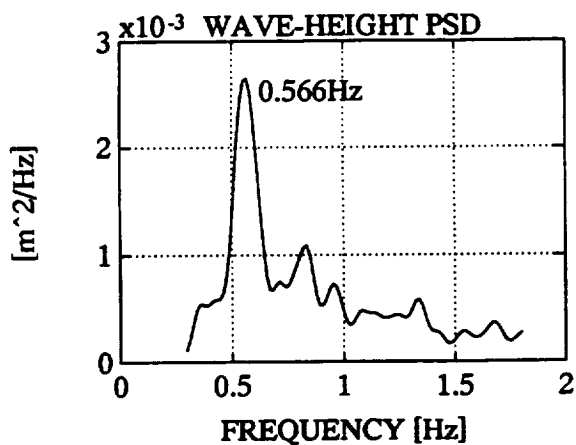
July 19, 1989, Run Time : 17:55: 7, Run # 13, C Band, HH Polarization, 40.0 deg. Incidence
 WindSpeed : 6.56 m/s, Air Temp. : 21.1 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



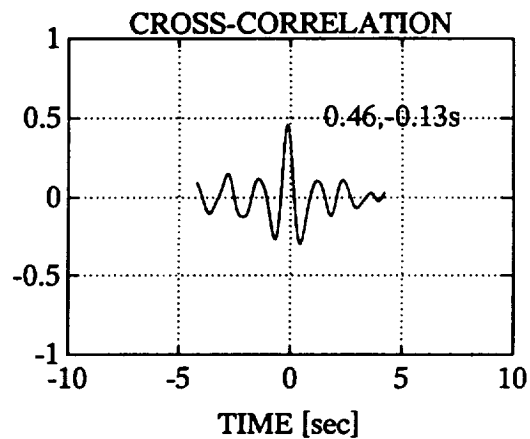
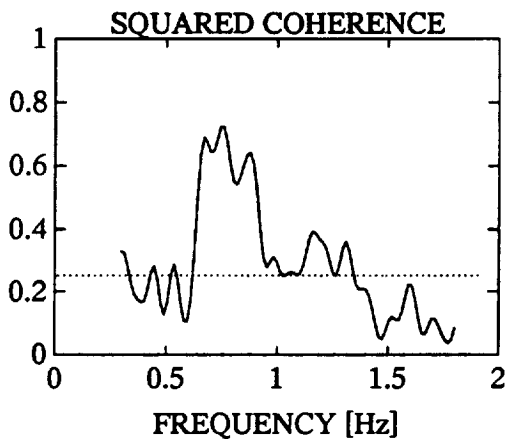
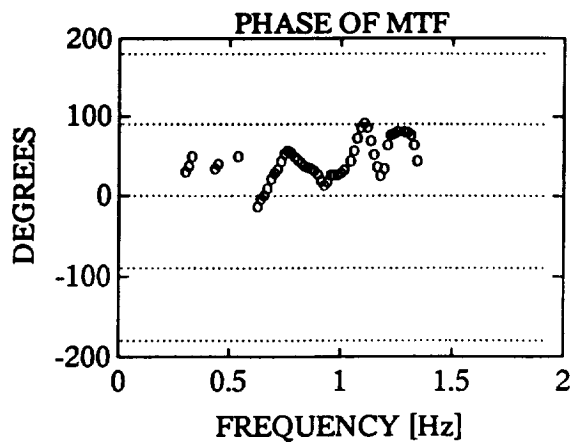
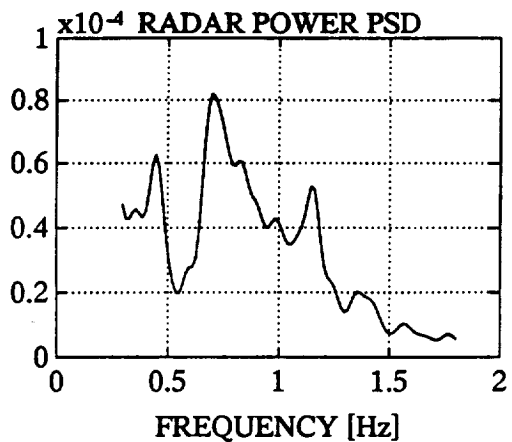
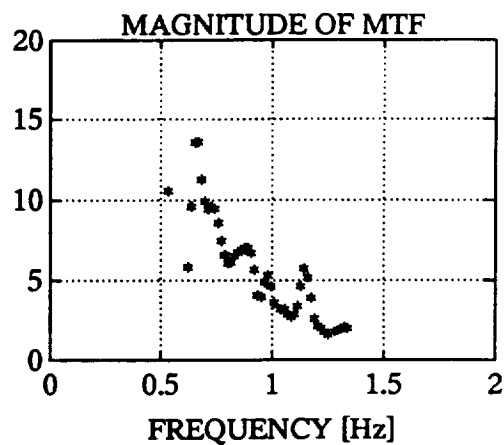
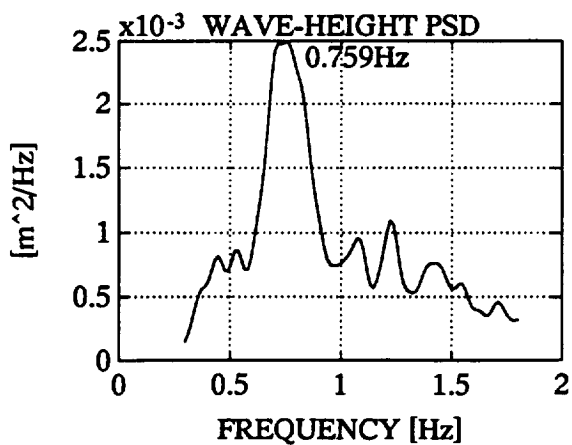
July 19, 1989, Run Time : 17:55: 7, Run # 13, C Band, HH Polarization, 40.0 deg. Incidence
 WindSpeed : 6.56 m/s, Air Temp. : 21.1 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



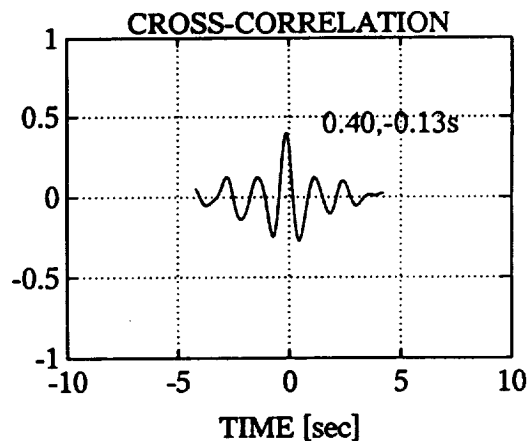
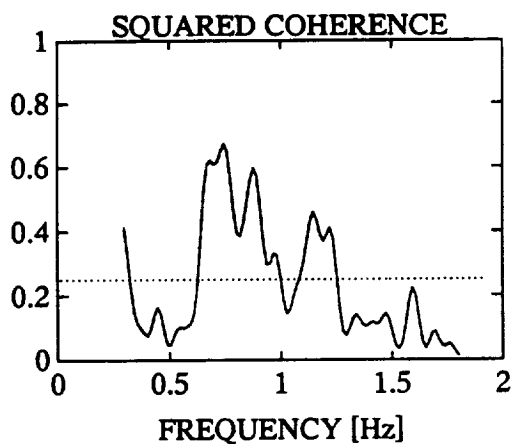
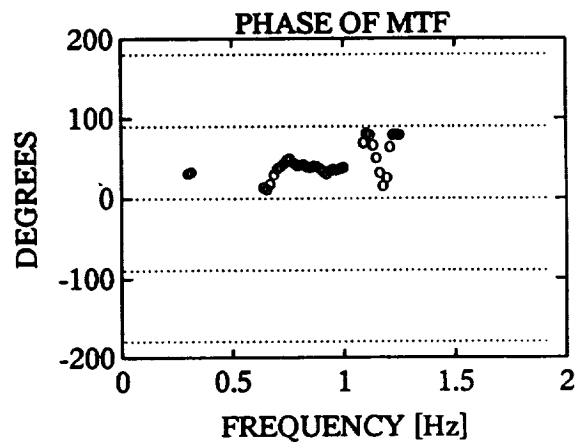
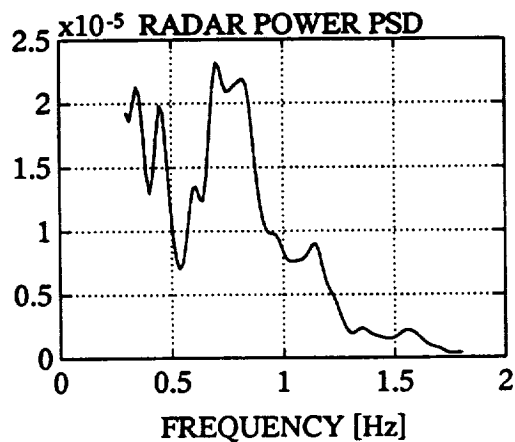
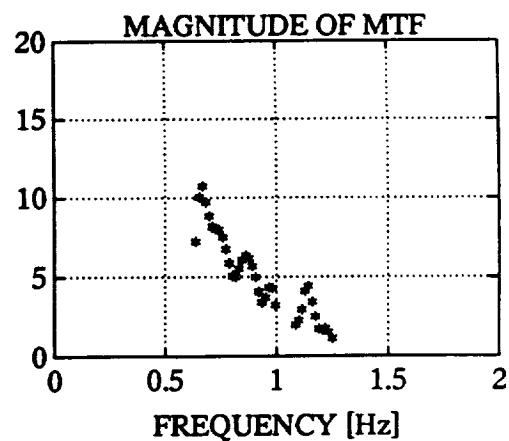
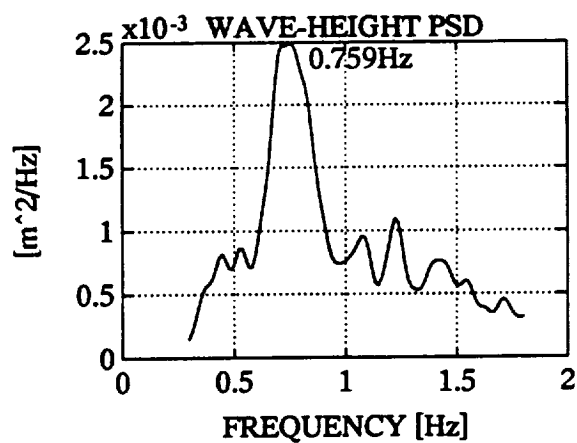
July 19, 1989, Run Time : 18:17:25, Run # 16, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 7.01 m/s, Air Temp. : 21.5 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



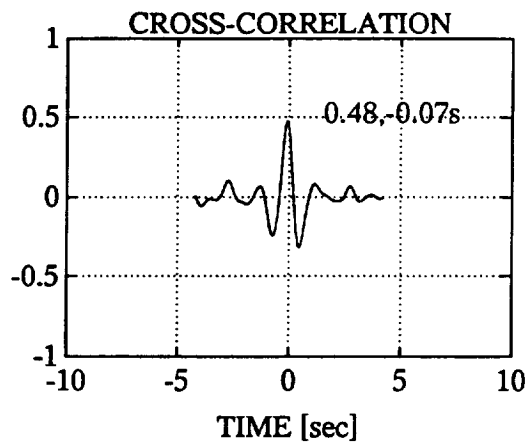
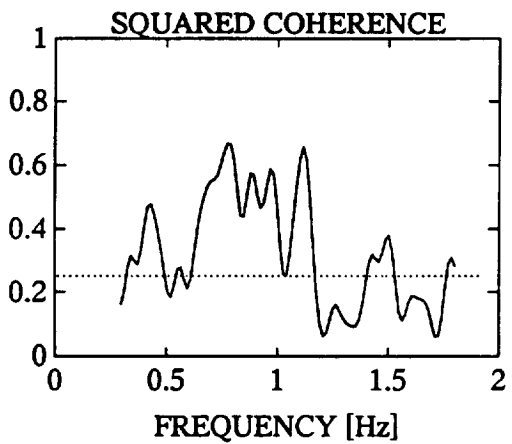
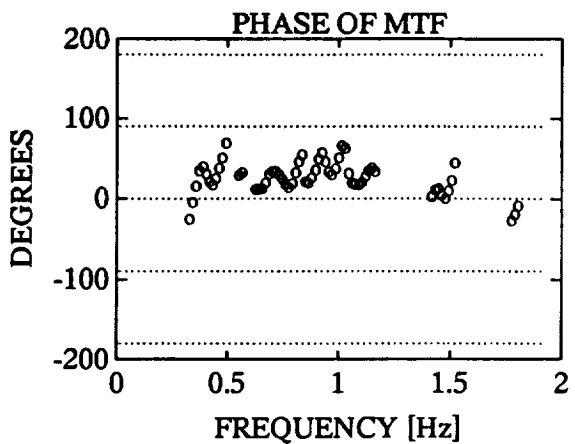
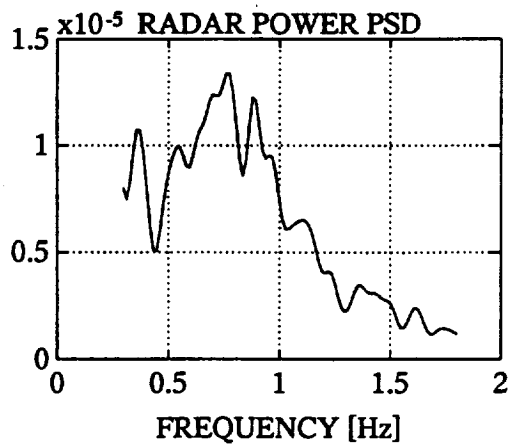
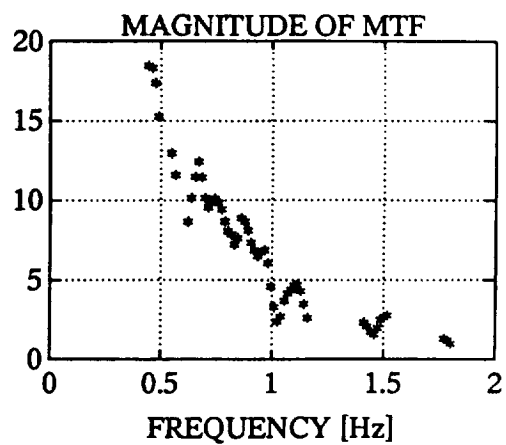
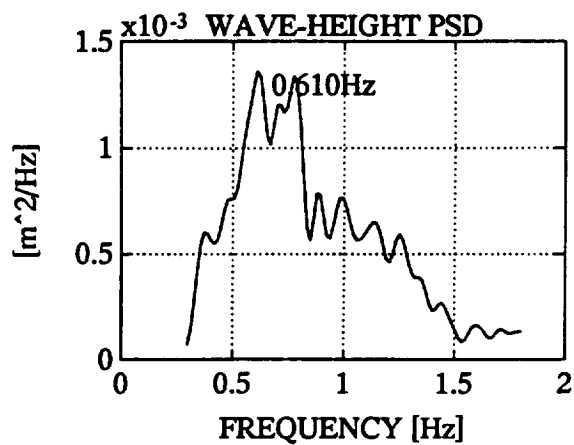
July 19, 1989, Run Time : 18:17:25, Run # 16, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 7.01 m/s, Air Temp. : 21.5 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



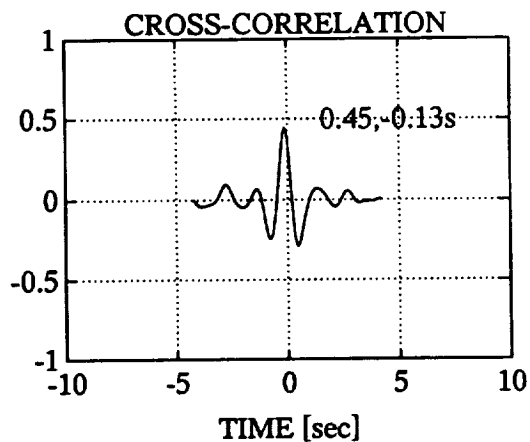
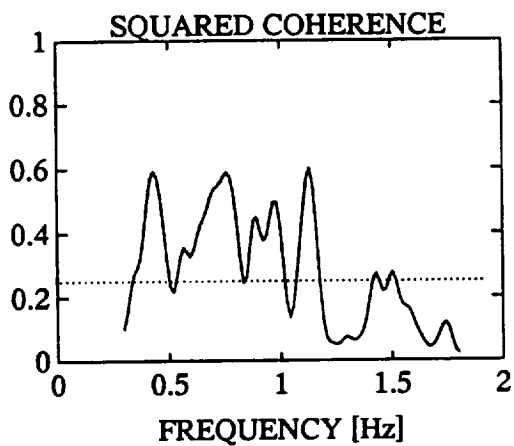
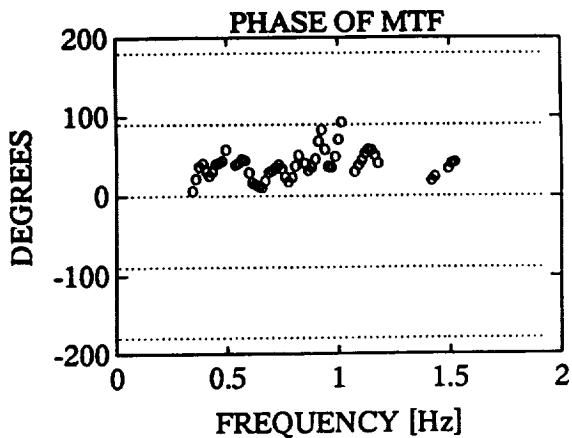
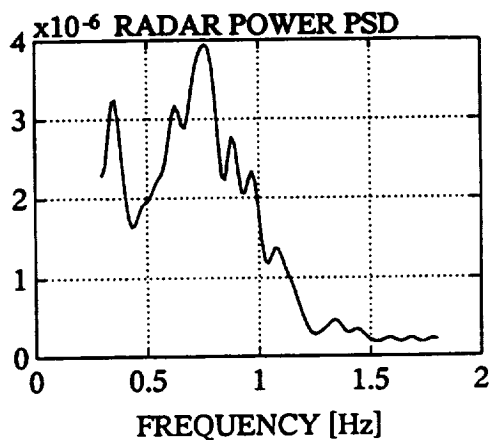
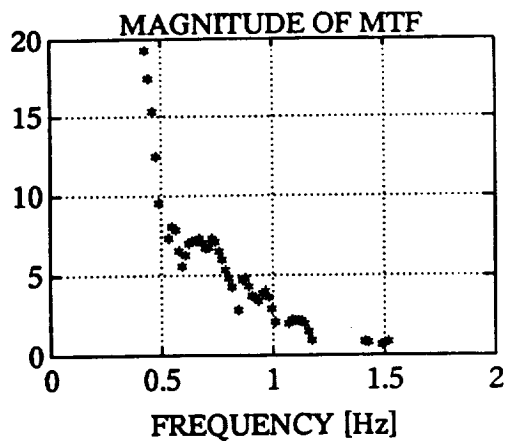
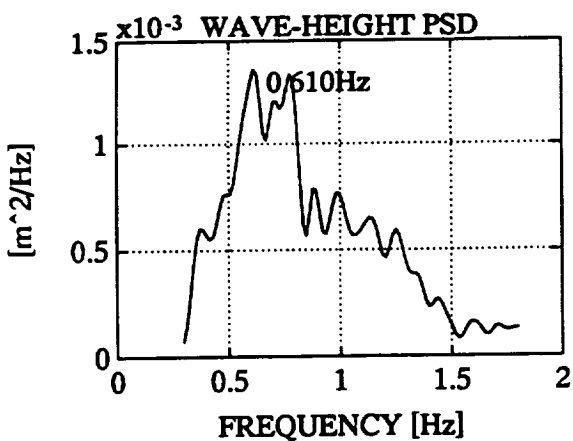
July 25, 1989, Run Time : 13:23:37, Run # 7, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.46 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



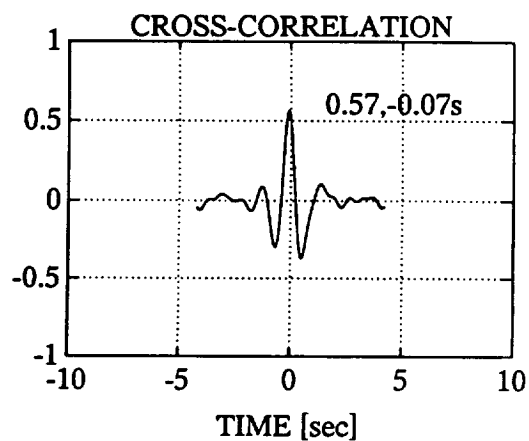
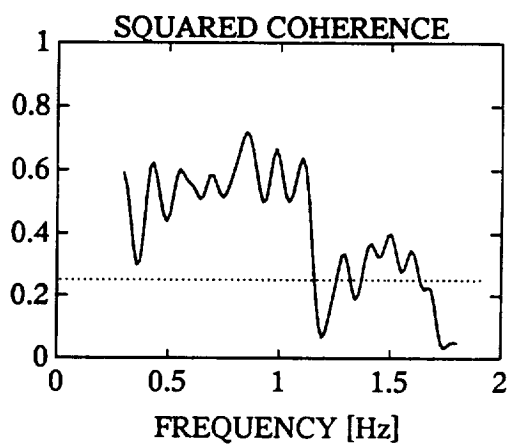
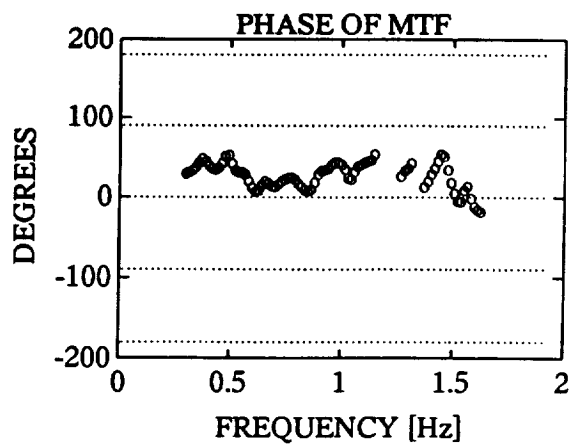
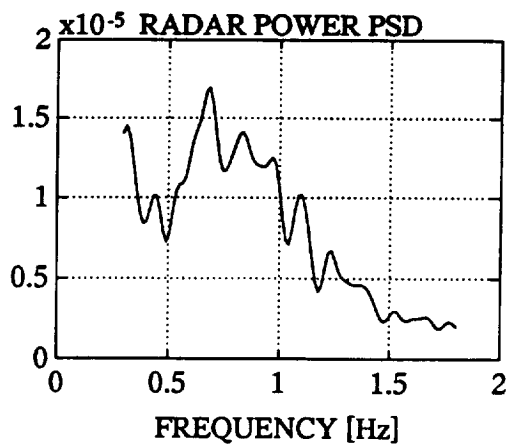
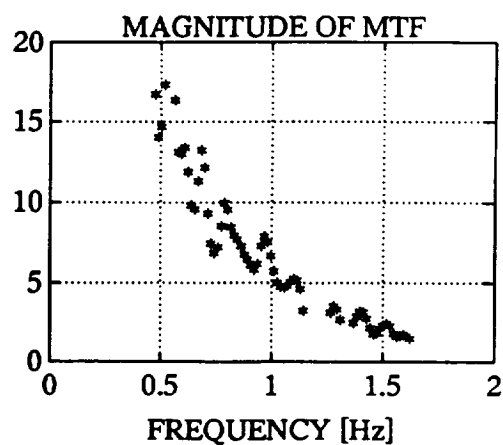
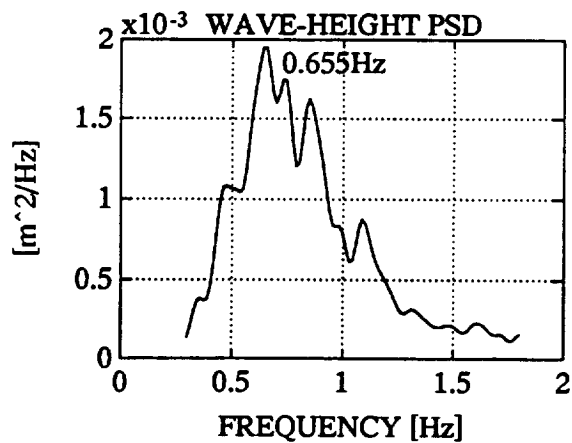
July 25, 1989, Run Time : 13:23:37, Run # 7, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.46 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



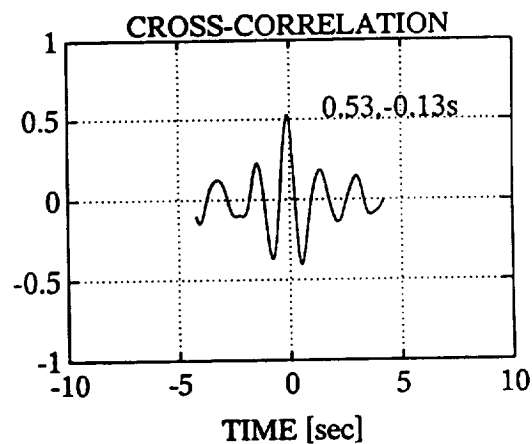
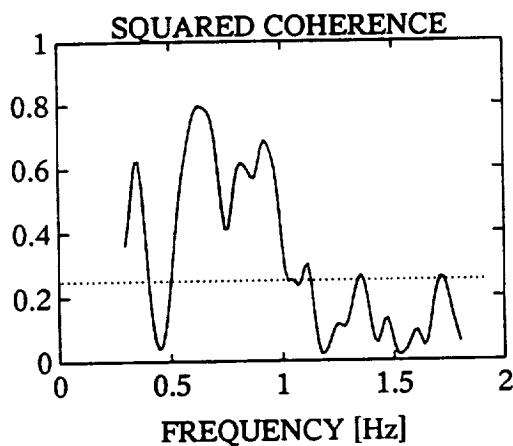
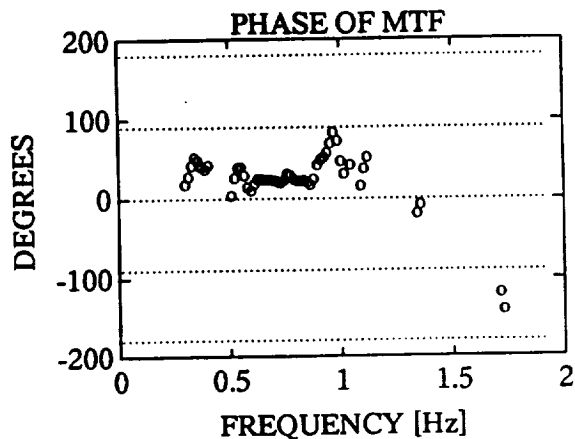
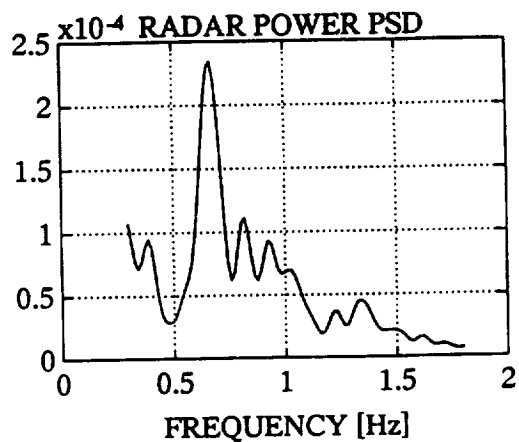
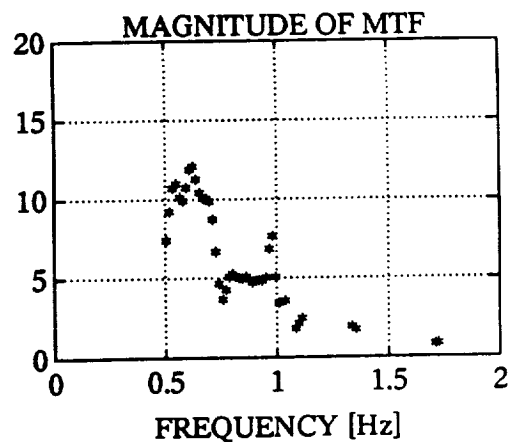
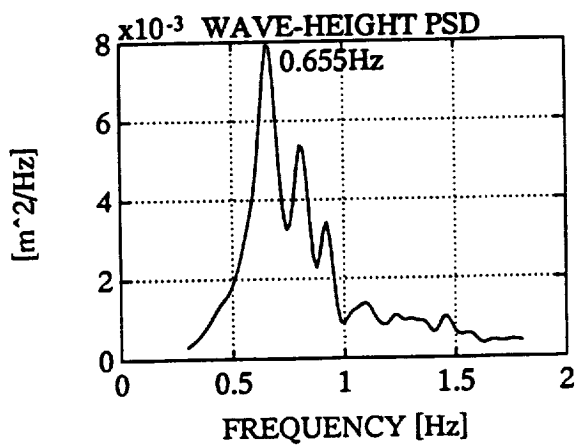
July 25, 1989, Run Time : 113:58:14, Run # 12, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.39 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



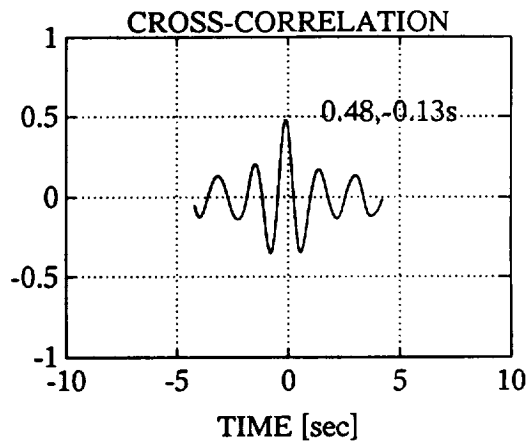
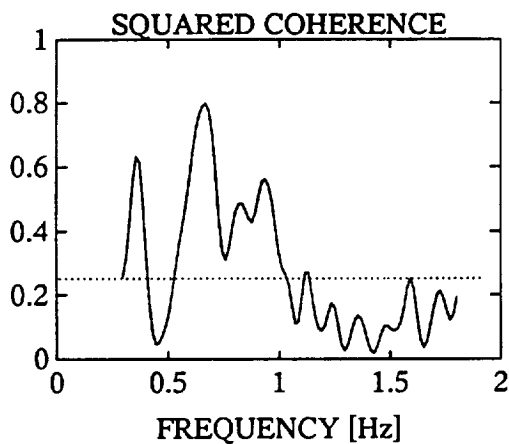
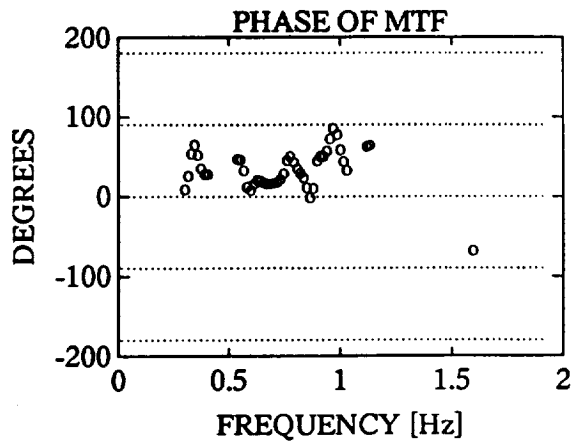
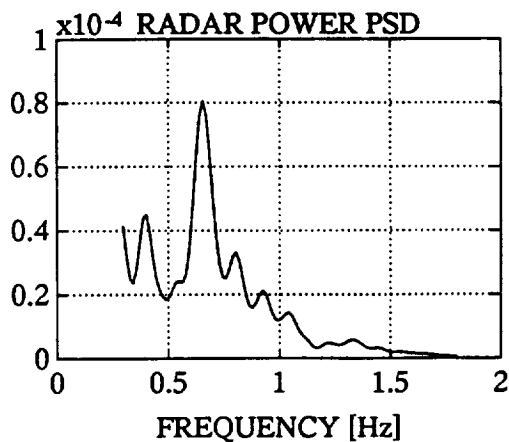
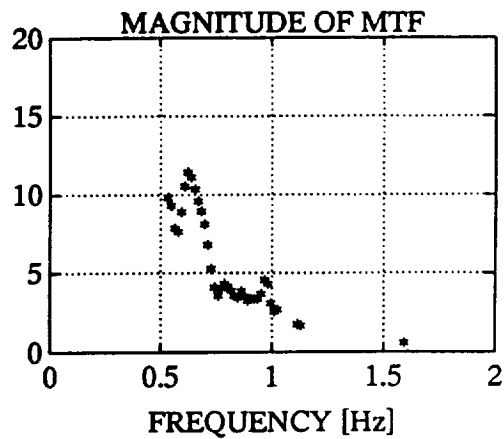
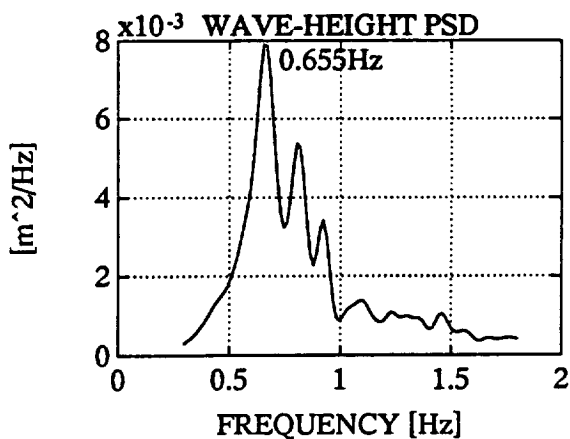
July 25, 1989, Run Time : 113:58:14, Run # 12, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.39 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



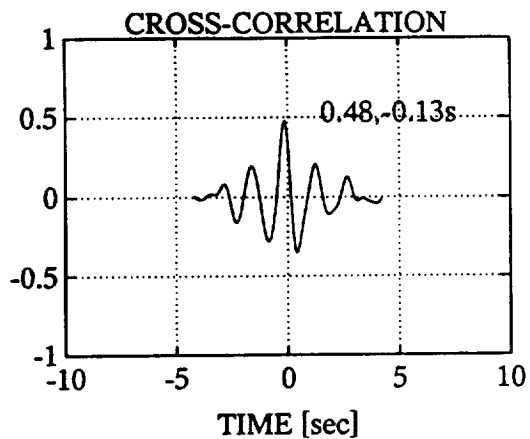
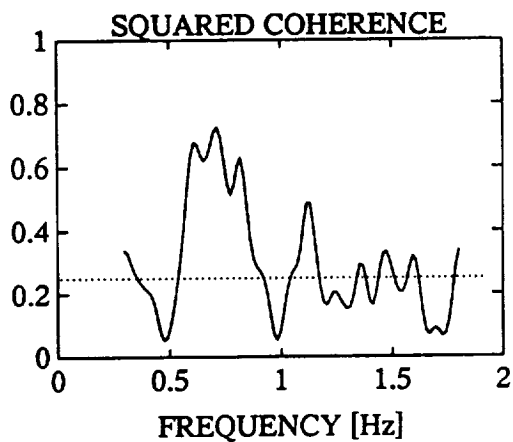
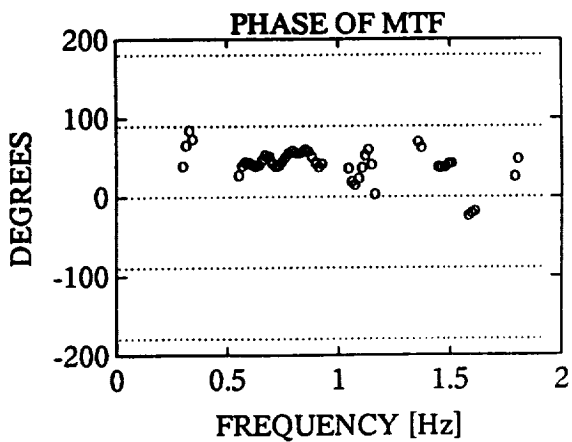
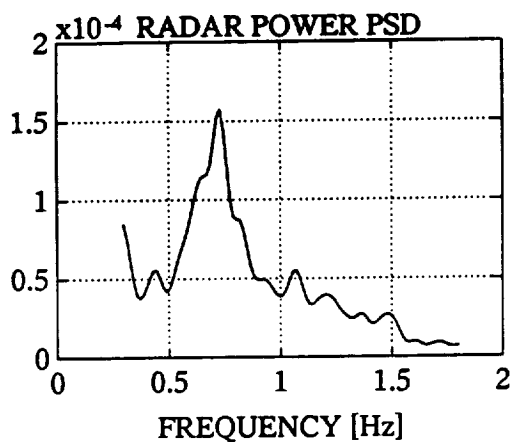
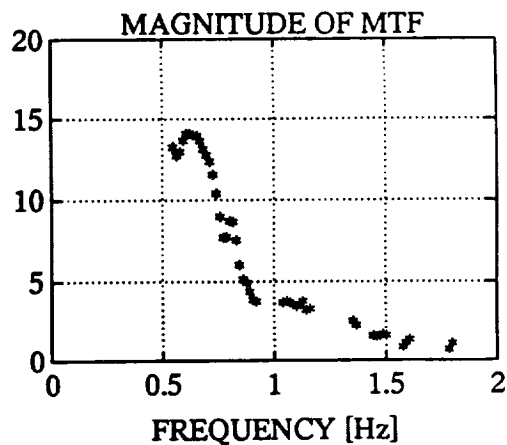
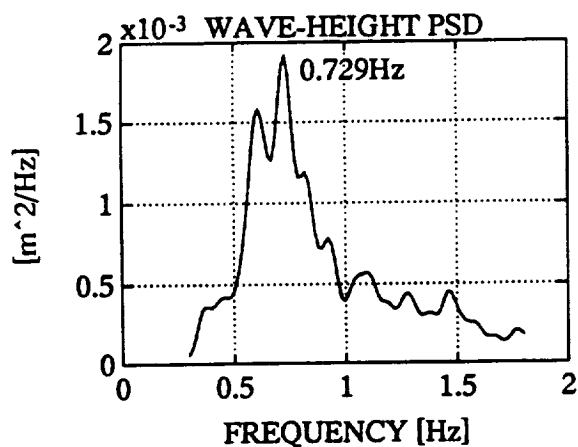
July 25, 1989, Run Time : 14: 3:32, Run # 13, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 3.90 m/s, Air Temp. : 21.1 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



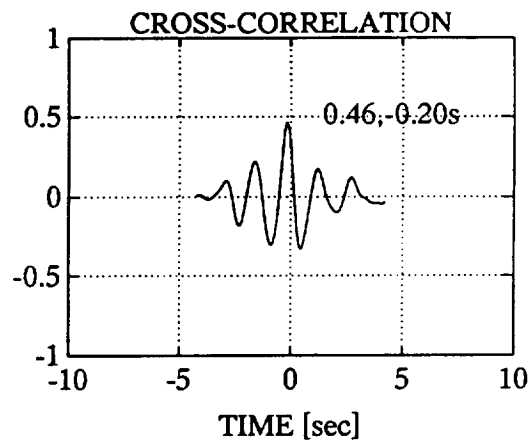
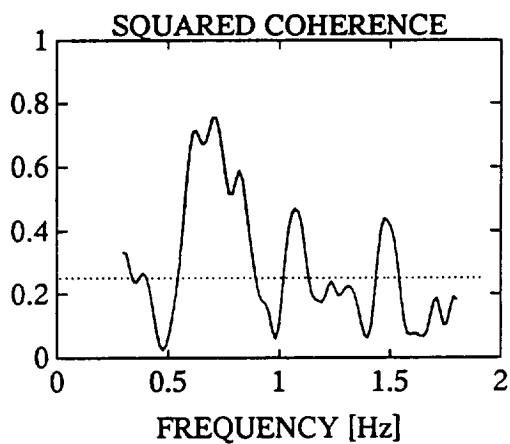
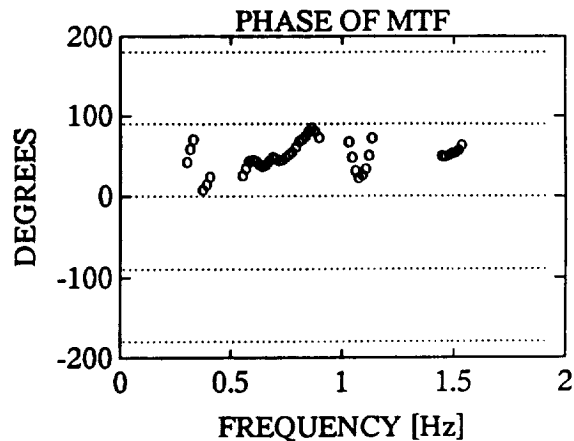
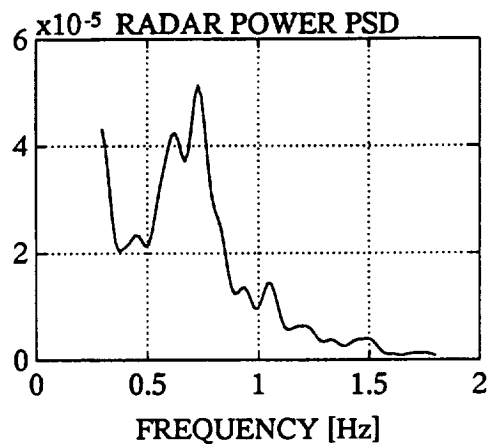
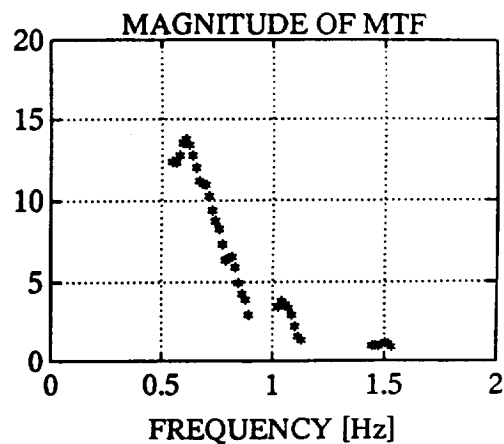
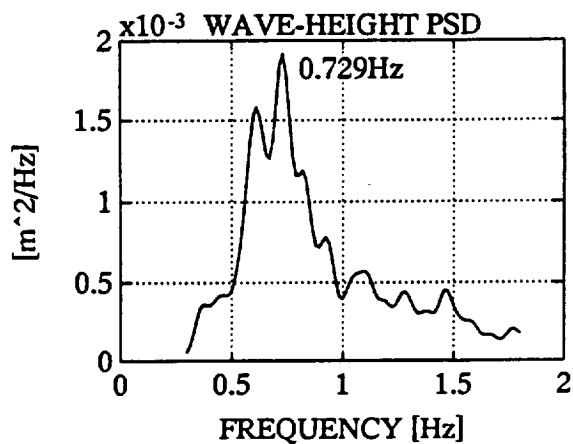
Aug. 3, 1989, Run Time : 18:24:43, Run # 8, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 20.3 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



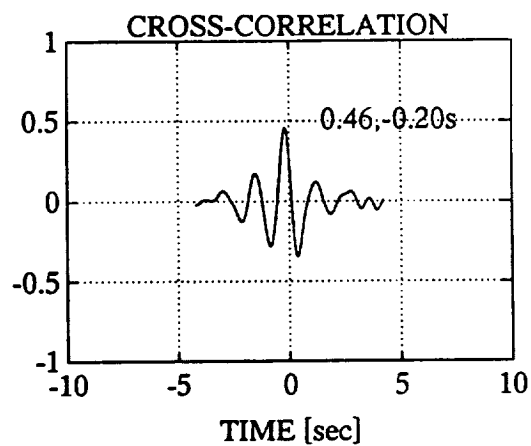
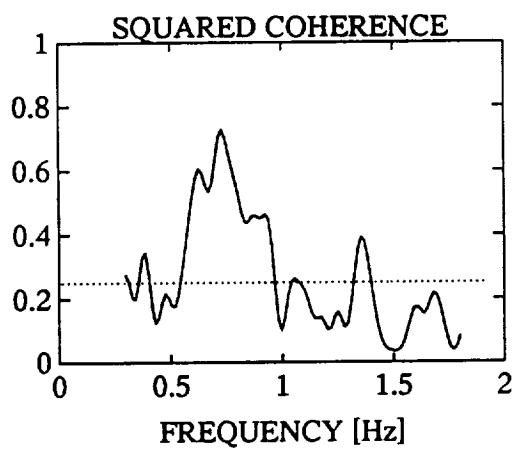
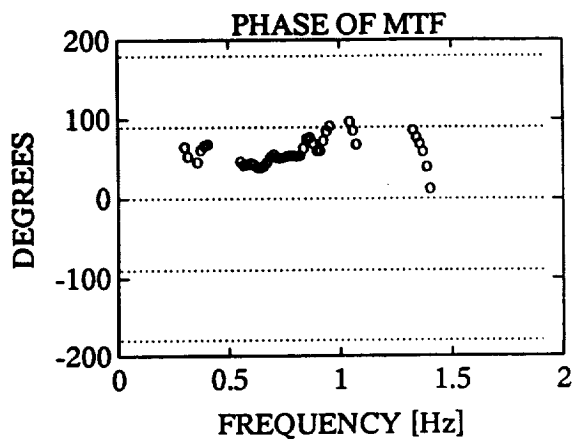
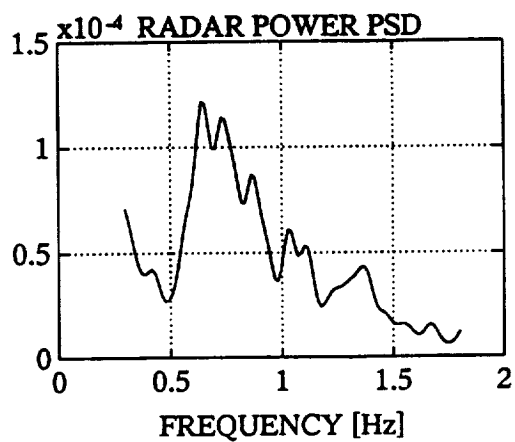
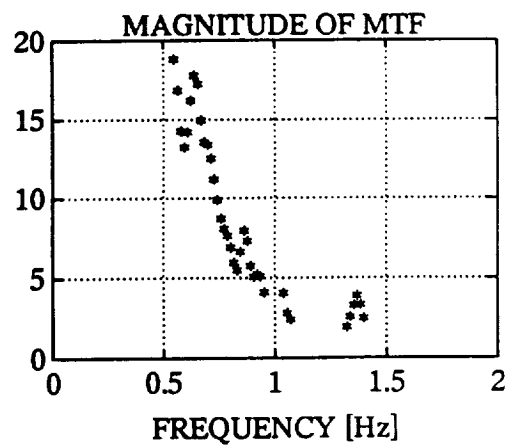
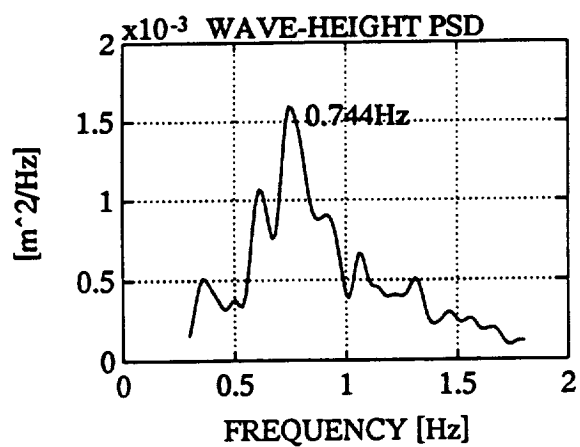
Aug. 3, 1989, Run Time : 18:24:43, Run # 8, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 20.3 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



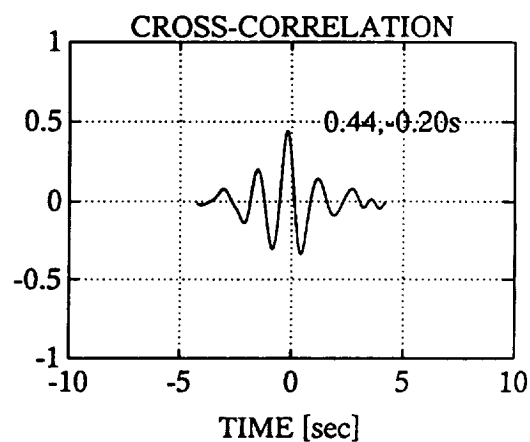
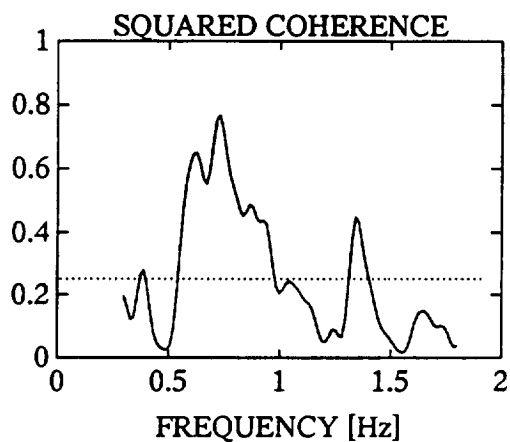
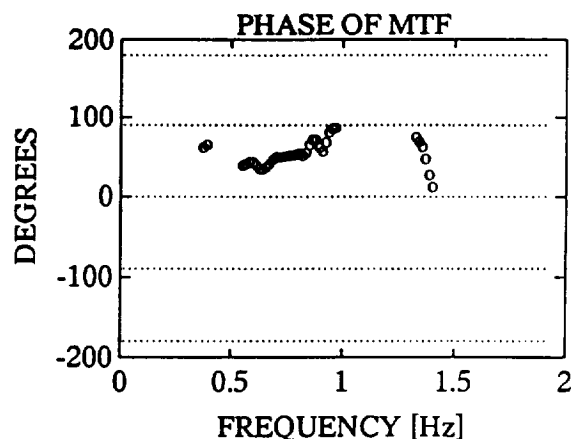
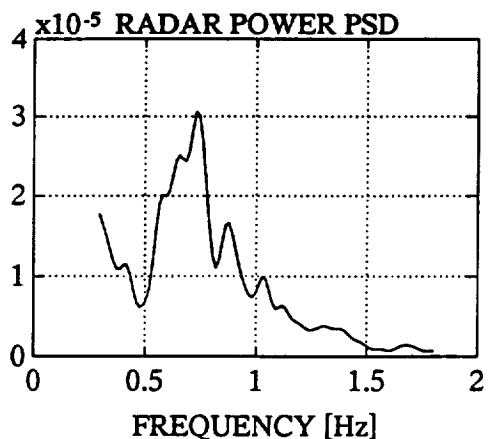
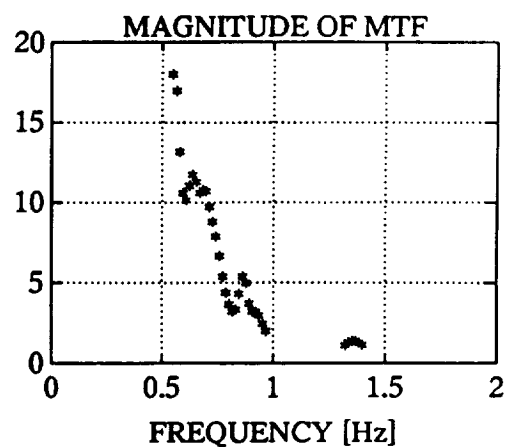
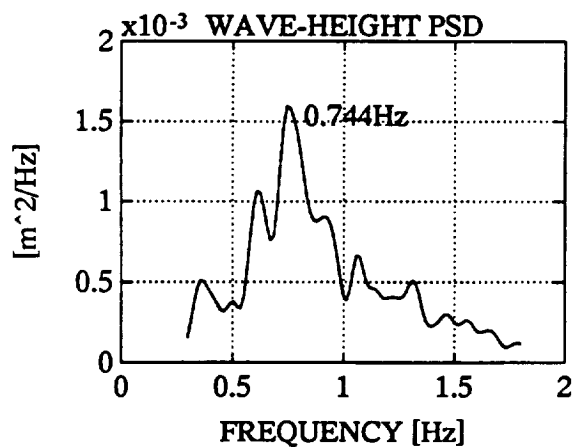
Aug. 3, 1989, Run Time : 18:38:36, Run # 10, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.91 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



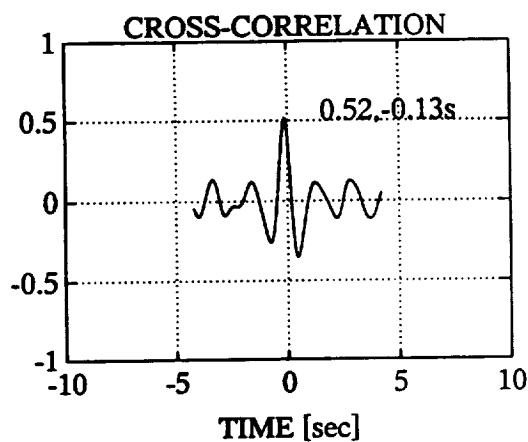
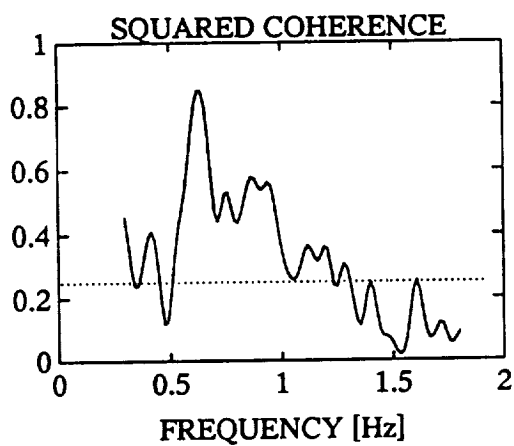
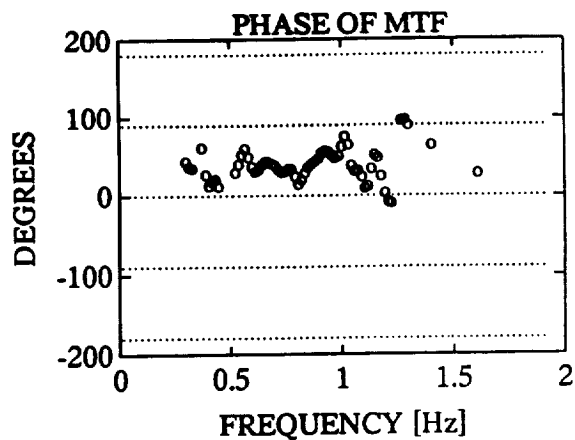
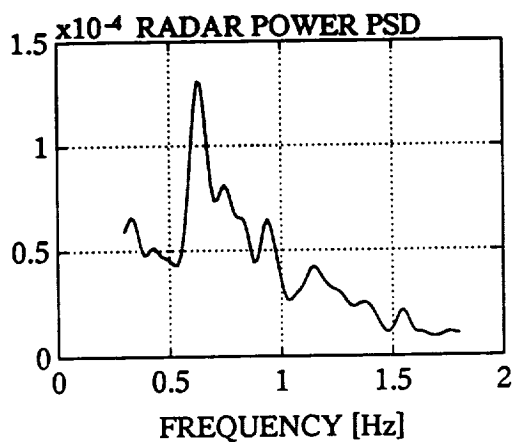
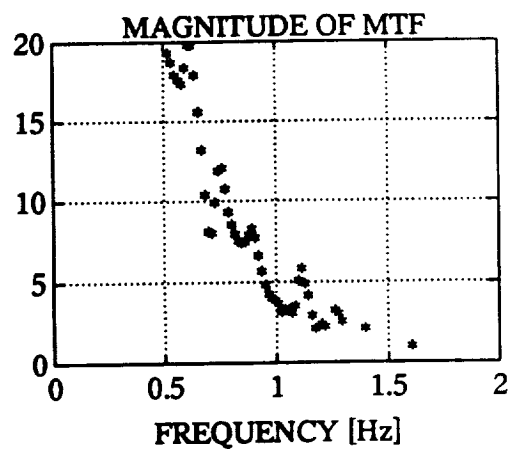
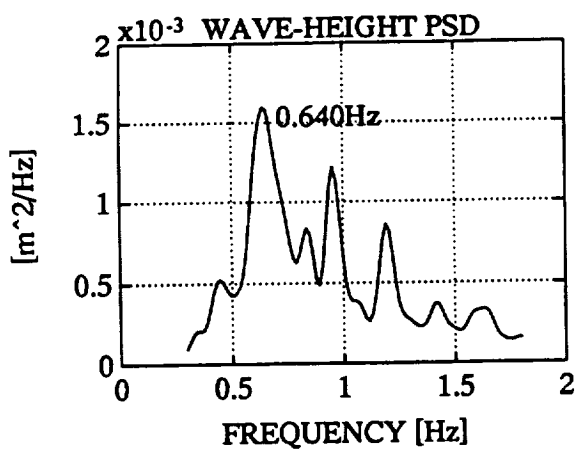
Aug. 3, 1989, Run Time : 18:38:36, Run # 10, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.91 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



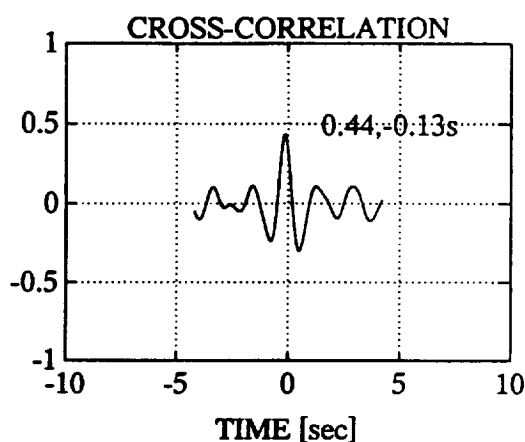
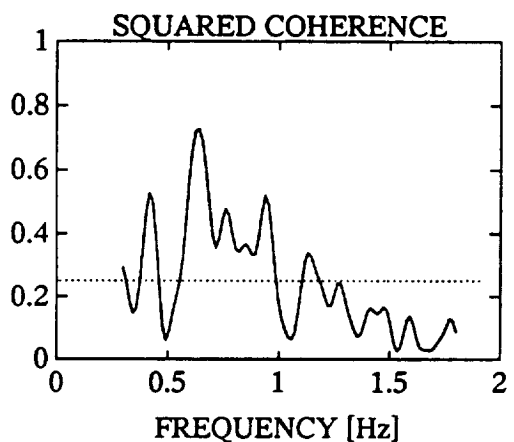
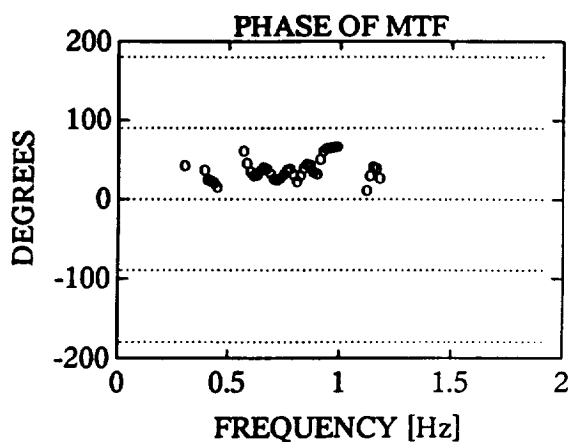
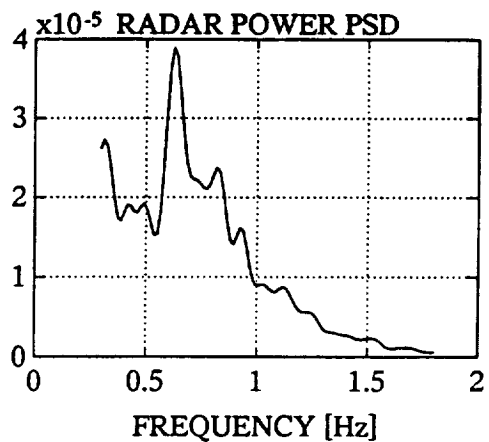
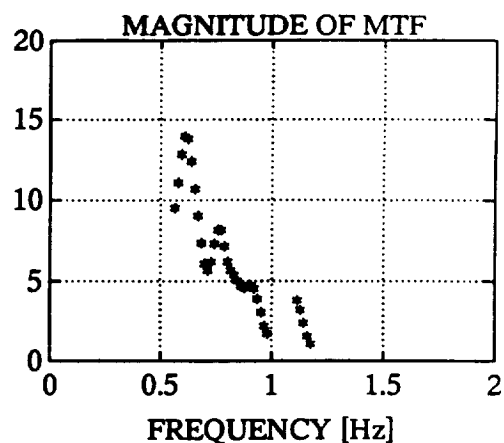
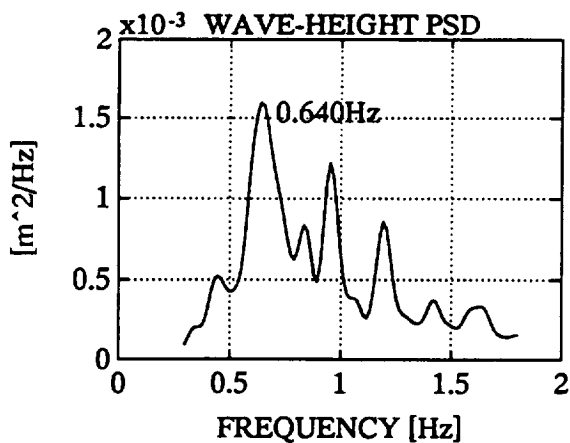
Aug. 3, 1989, Run Time : 18:44: 4, Run # 11, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.03 m/s, Air Temp. : 20.1 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



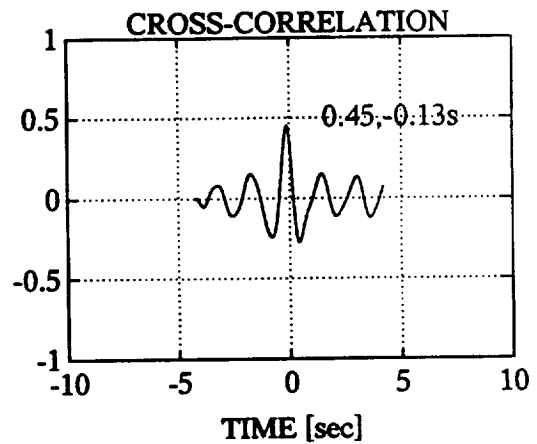
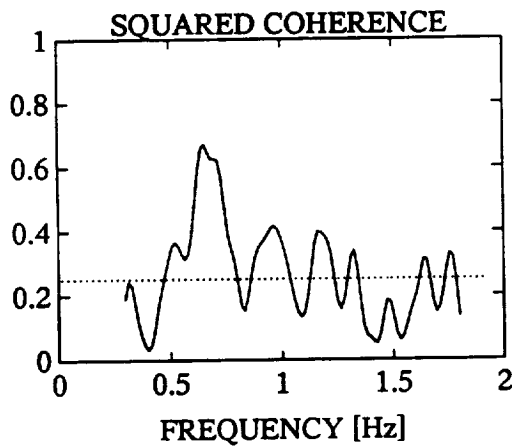
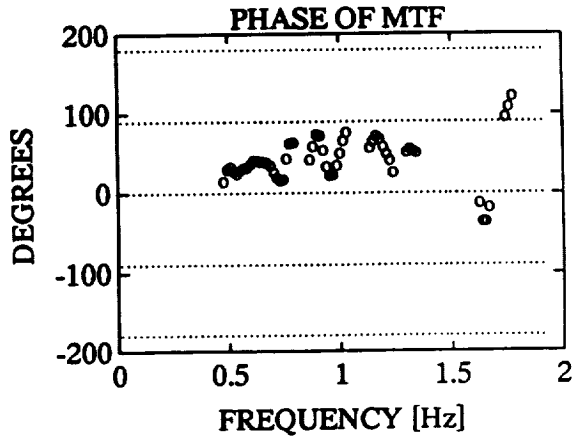
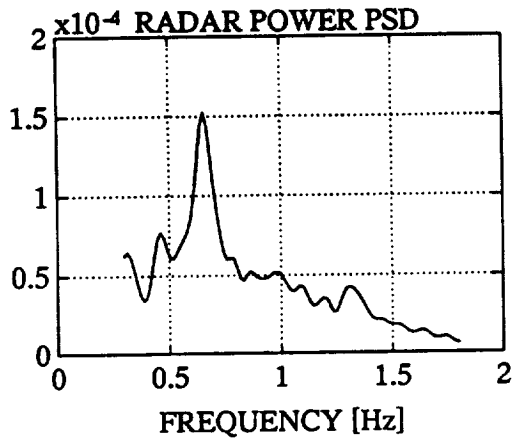
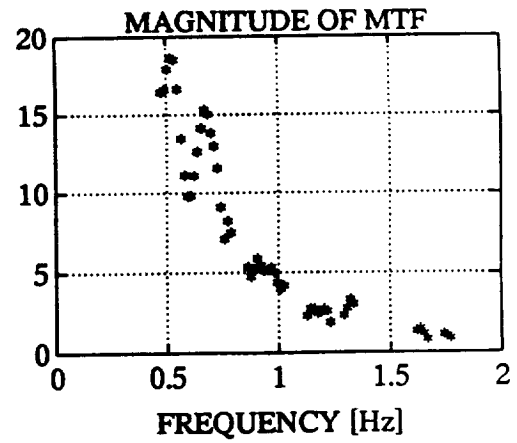
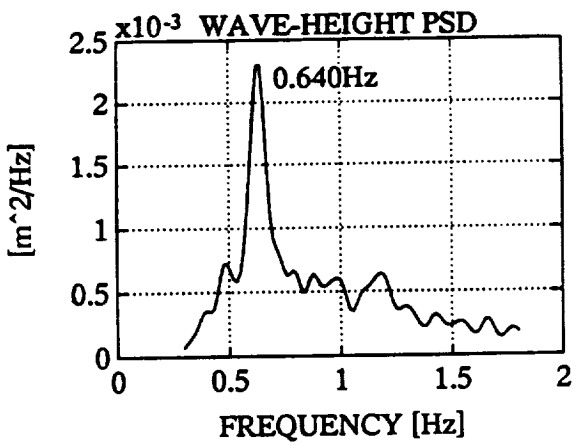
Aug. 3, 1989, Run Time : 18:44: 4, Run # 11, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.03 m/s, Air Temp. : 20.1 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



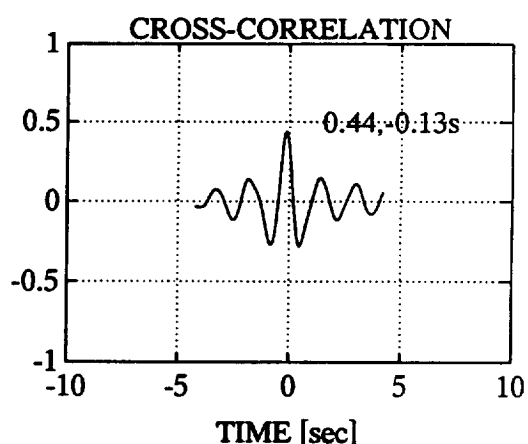
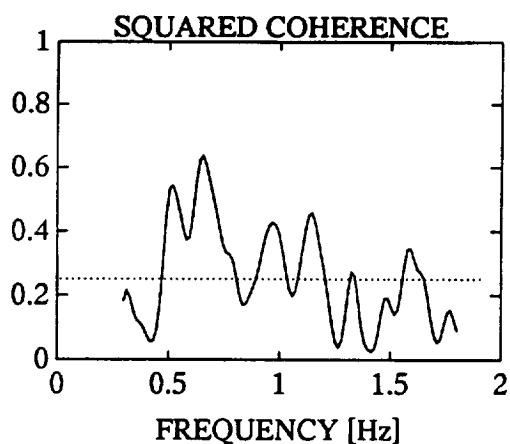
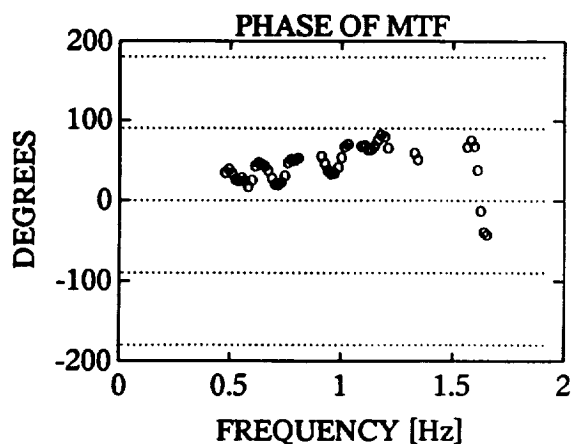
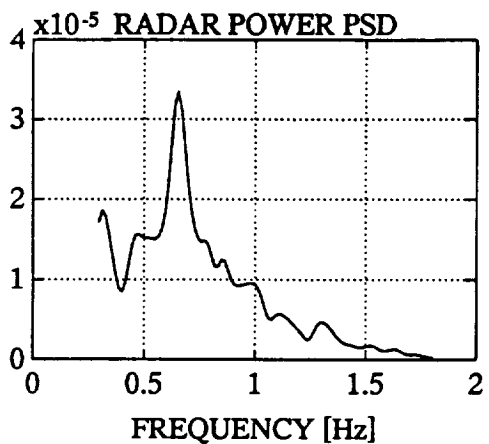
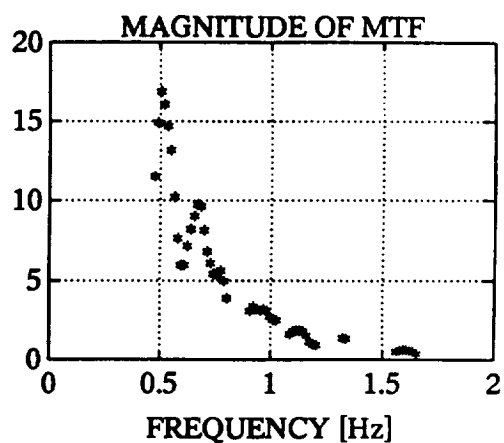
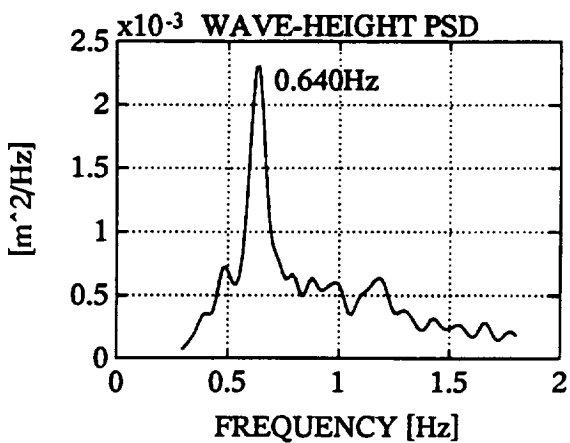
Aug. 3, 1989, Run Time : 19:31:29, Run # 15, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.24 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



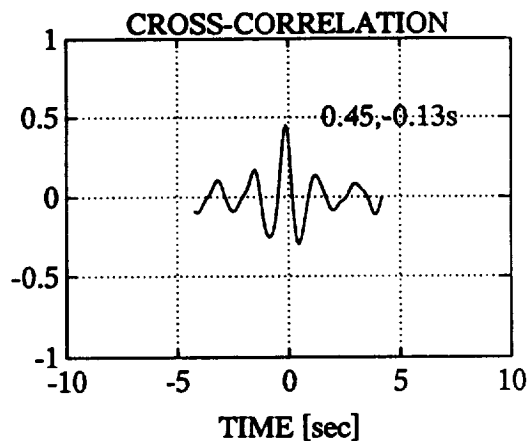
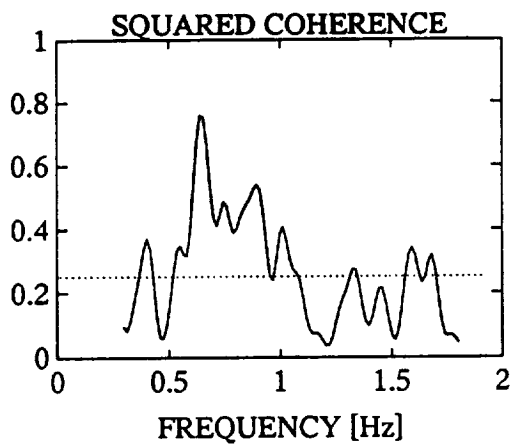
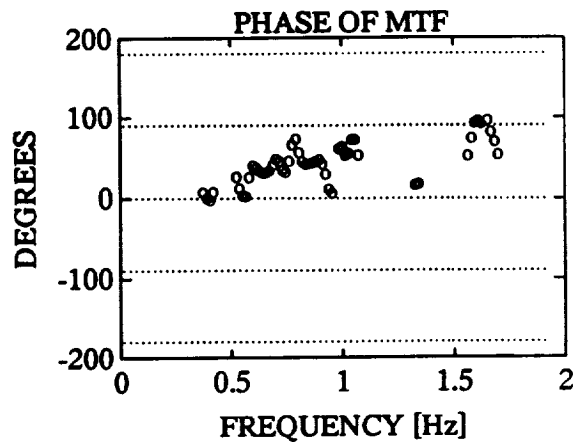
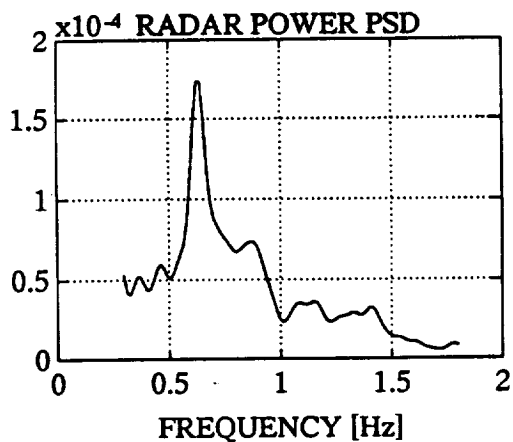
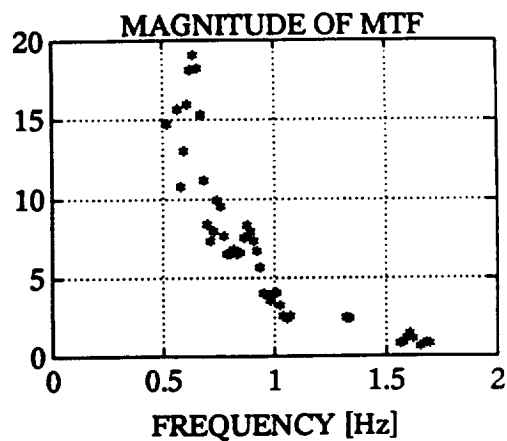
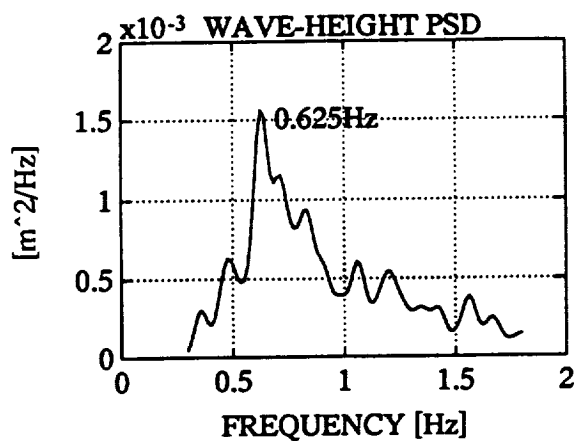
Aug. 3, 1989, Run Time : 19:31:29, Run # 15, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.24 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



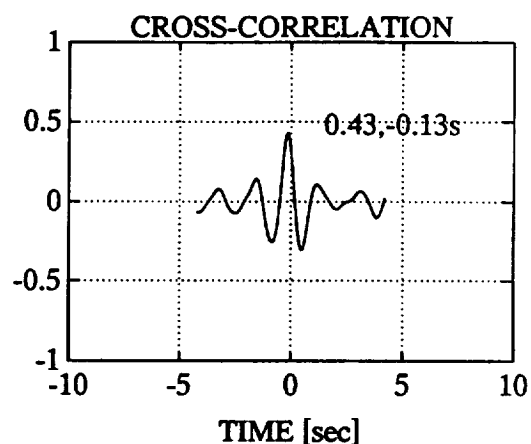
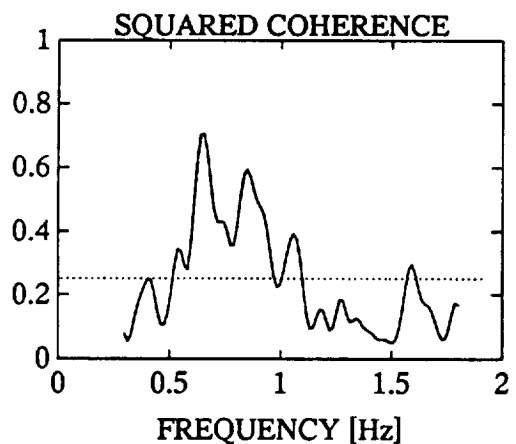
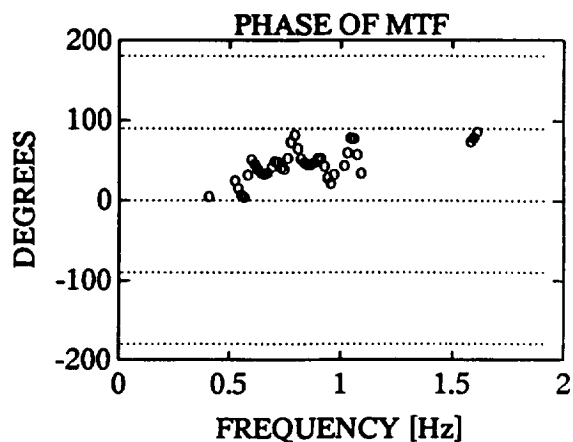
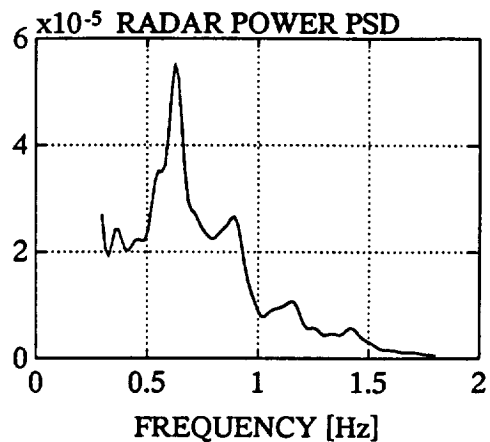
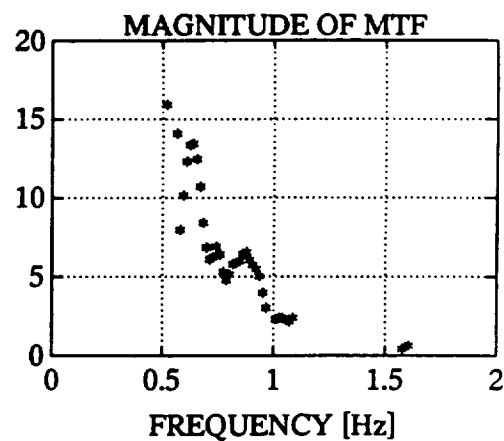
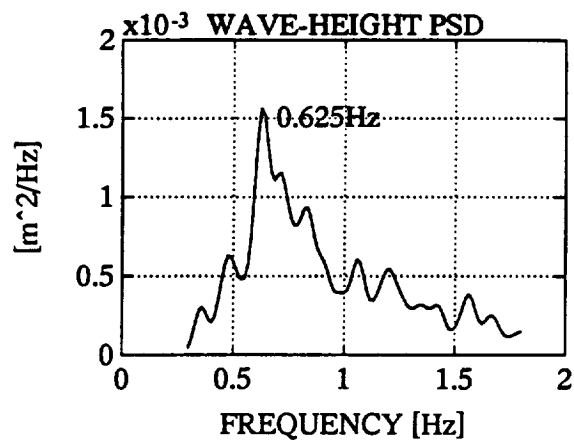
Aug. 3, 1989, Run Time : 19:37: 5, Run # 16, C Band, VV Polarization, 34.0 deg. Incidence
WindSpeed : 4.65 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
Antenna Look Dir. : Up-Wind, Spikes Present



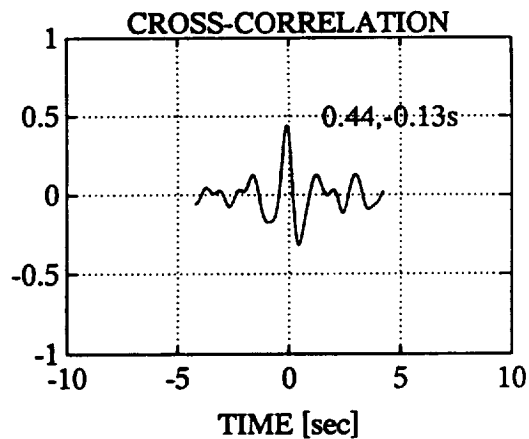
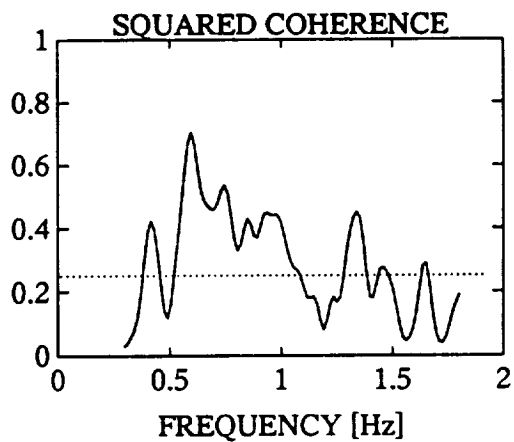
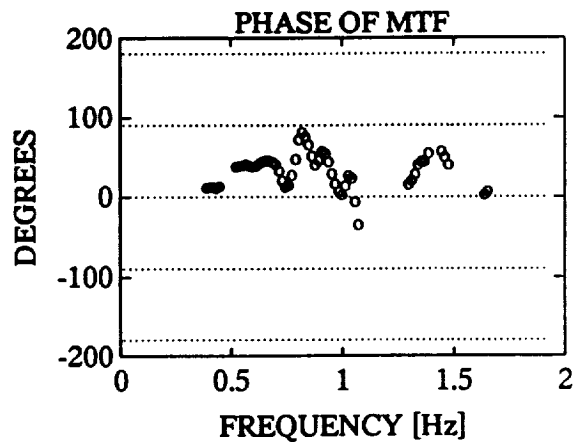
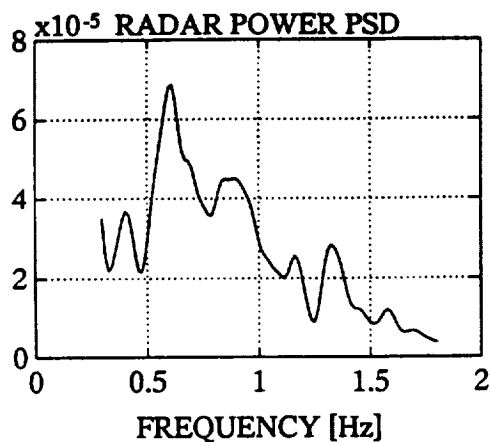
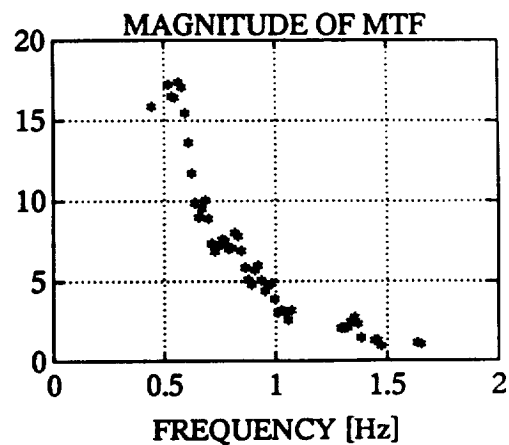
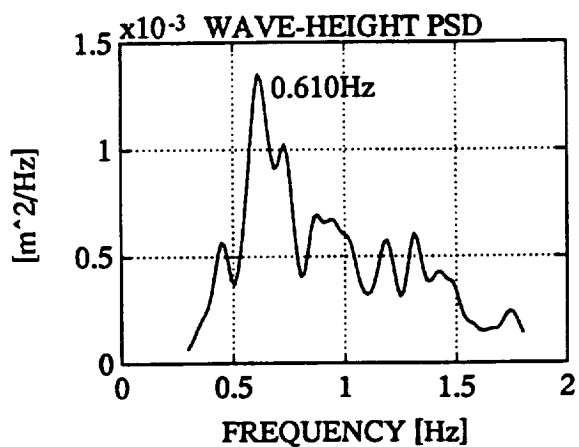
Aug. 3, 1989, Run Time : 19:37: 5, Run # 16, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.65 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



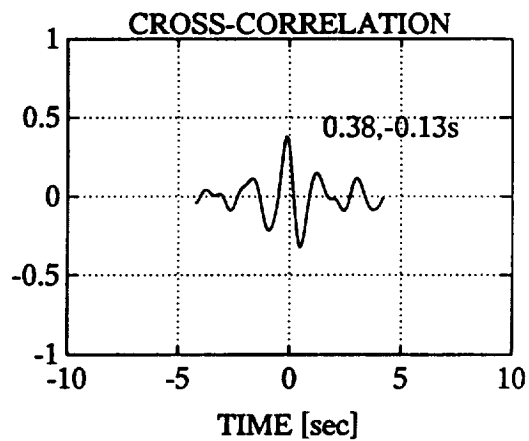
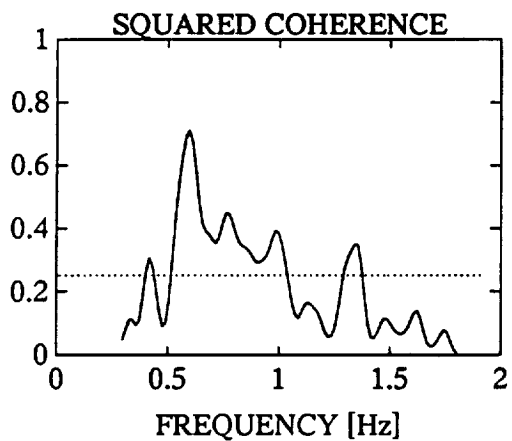
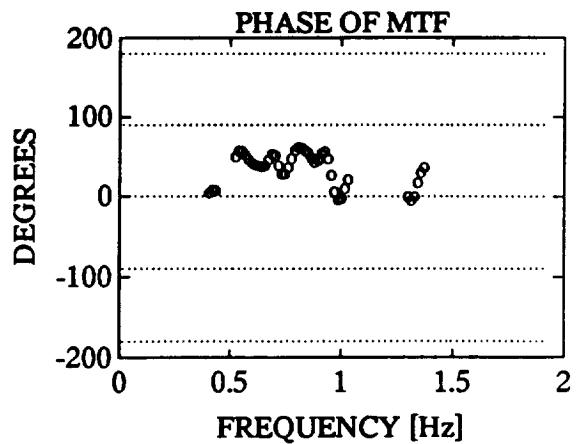
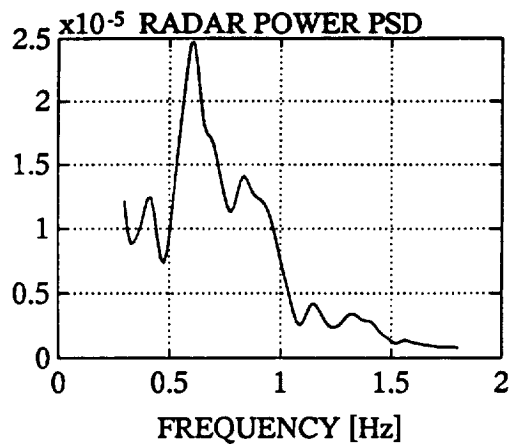
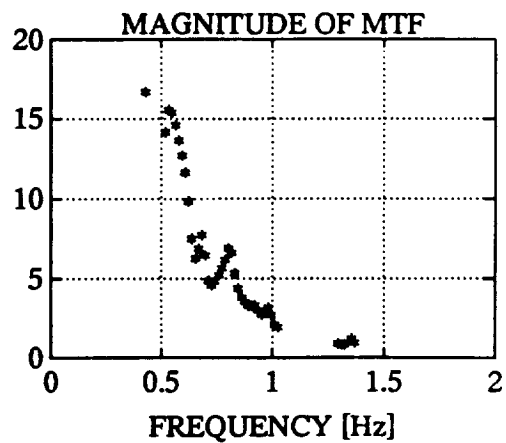
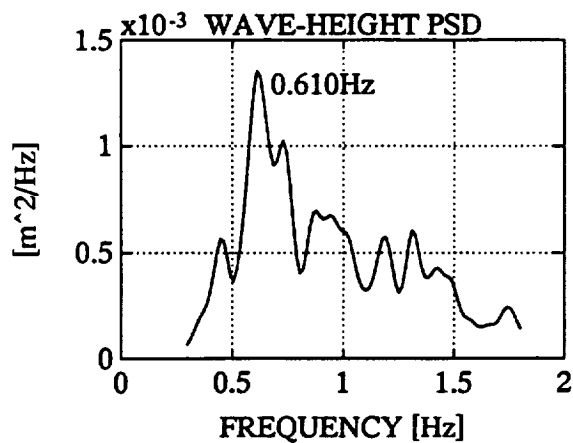
Aug. 3, 1989, Run Time : 19:54: 5, Run # 19, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.38 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



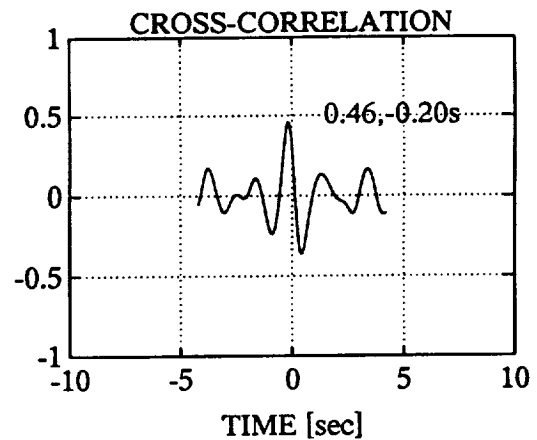
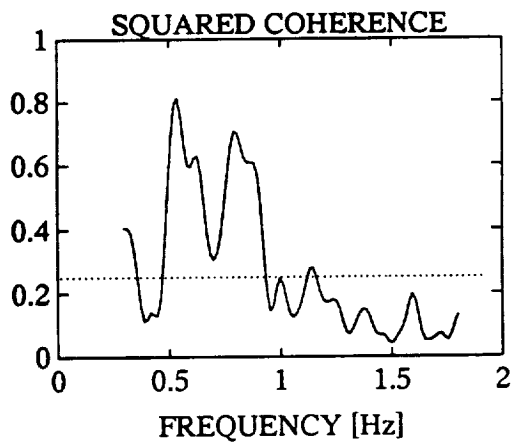
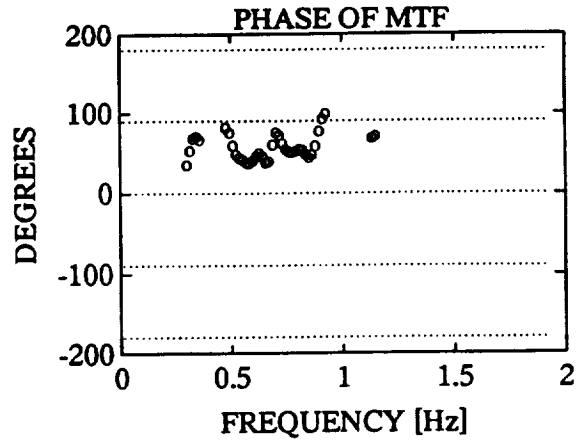
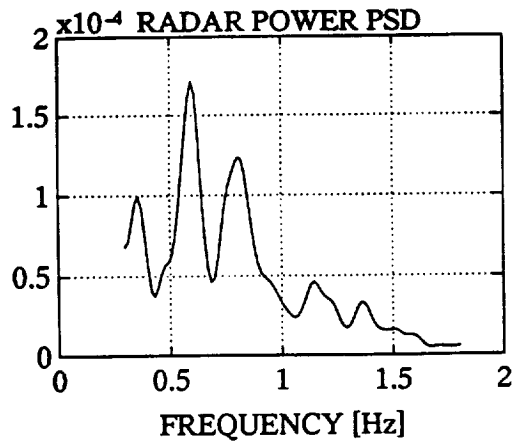
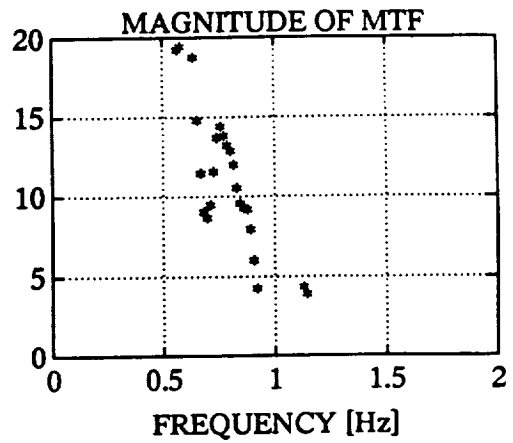
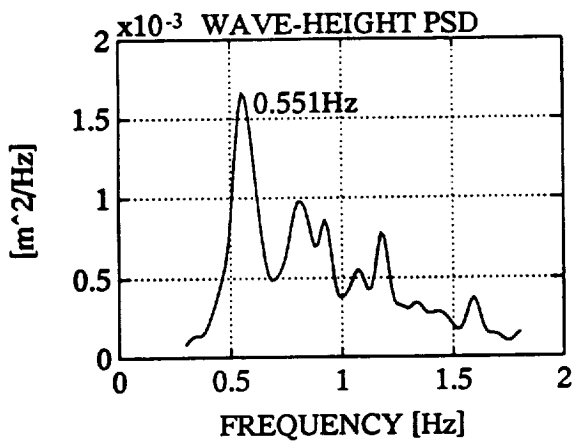
Aug. 3, 1989, Run Time : 19:54: 5, Run # 19, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.38 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



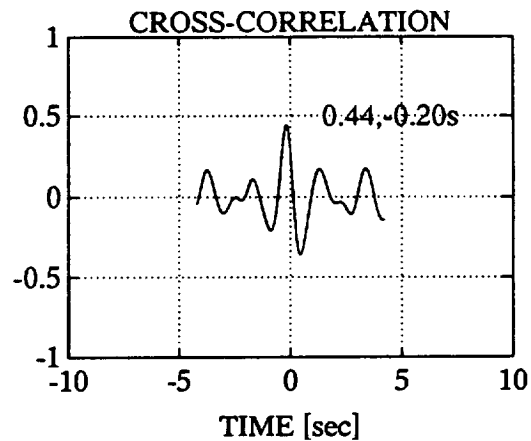
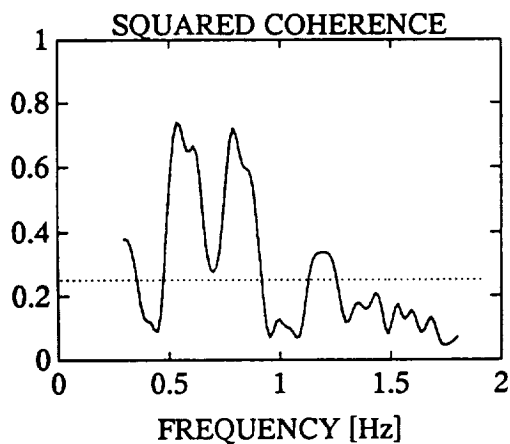
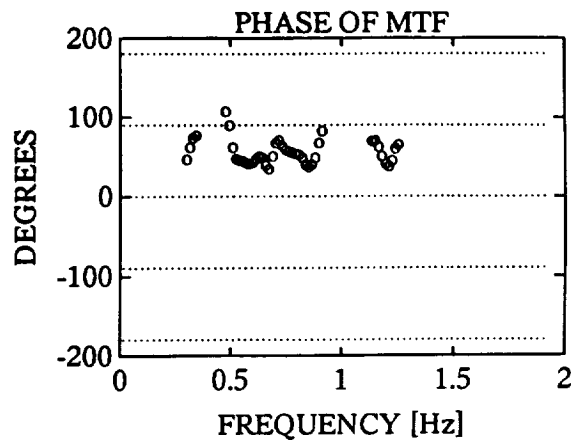
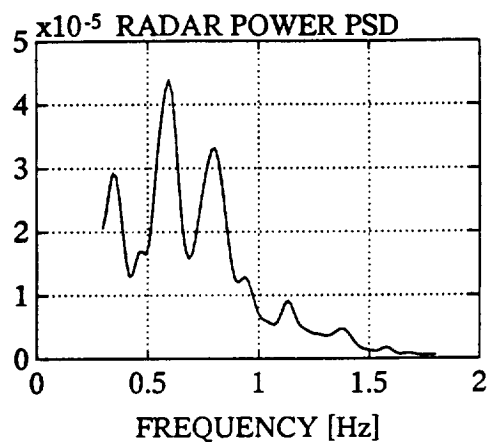
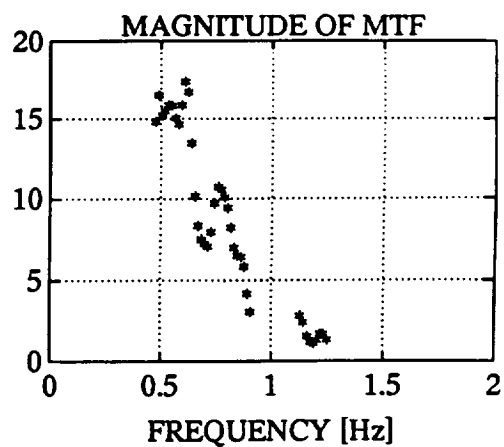
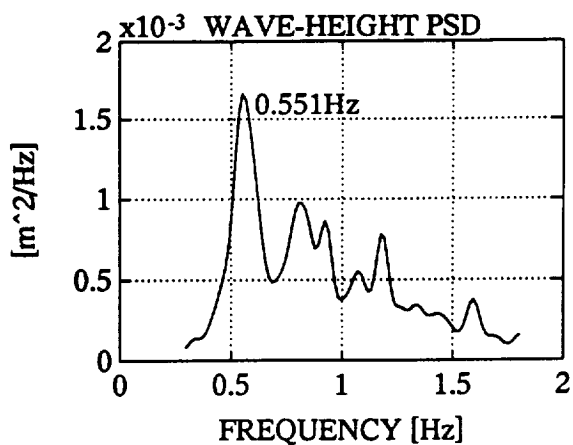
Aug. 3, 1989, Run Time : 20:11:10, Run # 22, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.09 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



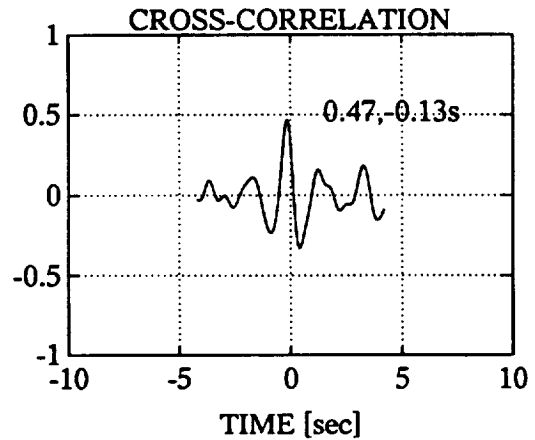
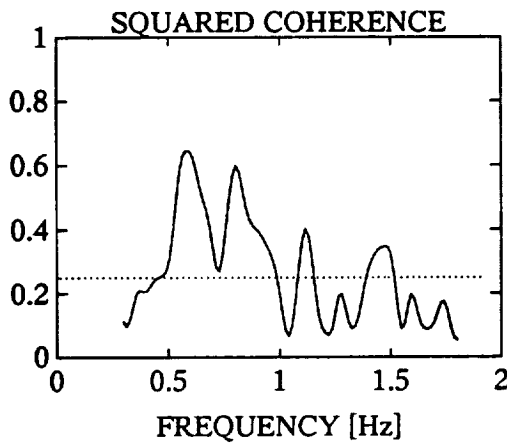
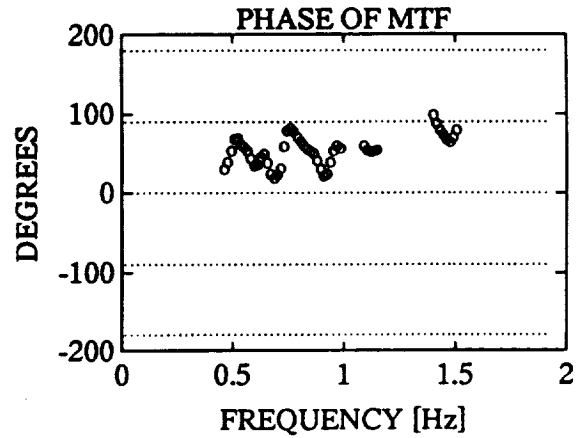
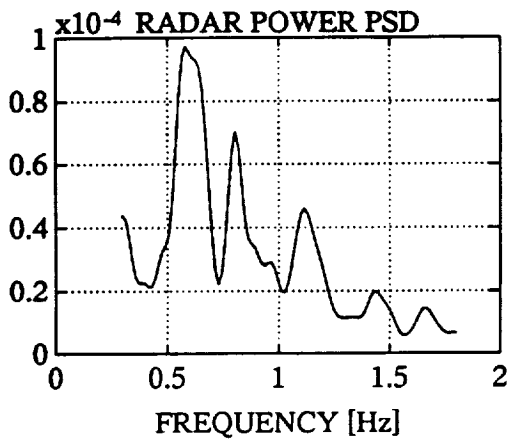
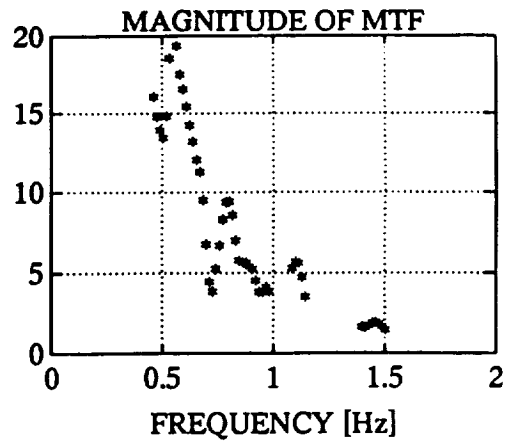
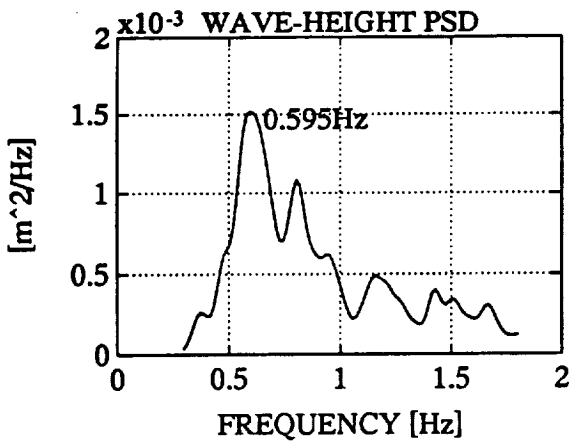
Aug. 3, 1989, Run Time : 20:11:10, Run # 22, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.09 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



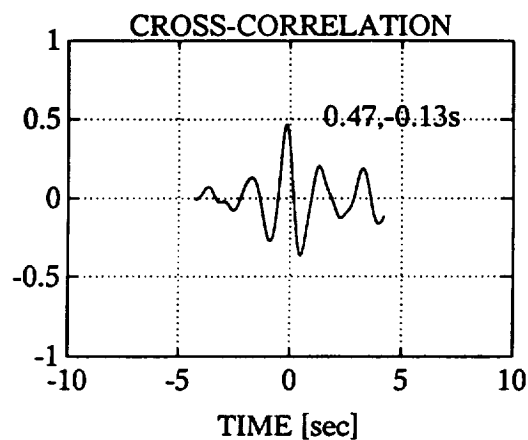
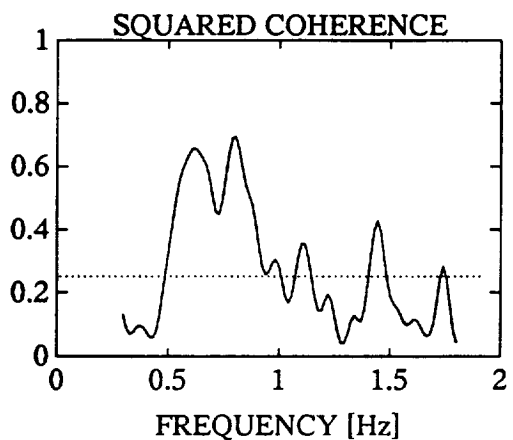
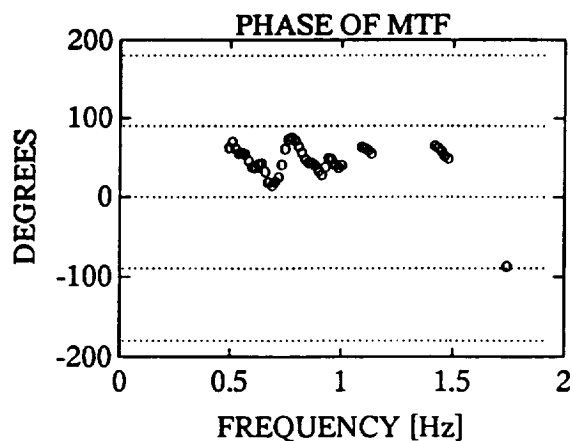
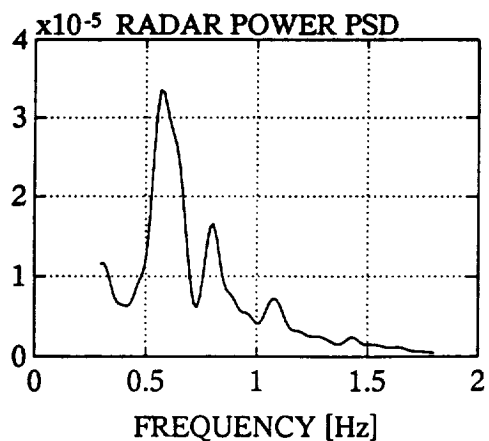
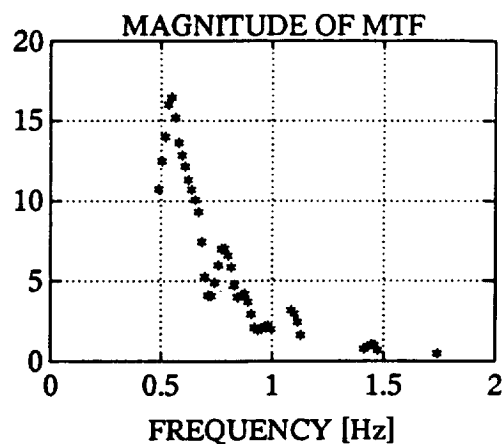
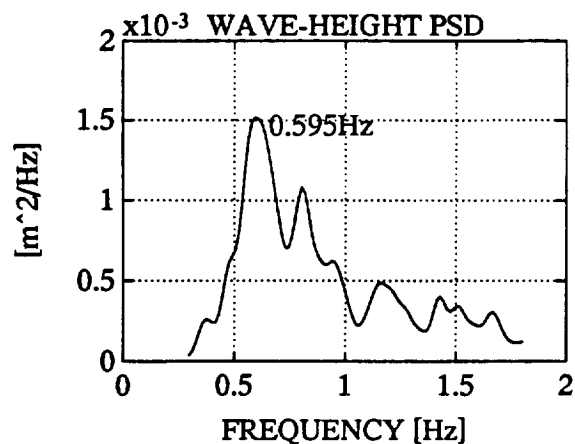
Aug. 4, 1989, Run Time : 17:35:50, Run # 18, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



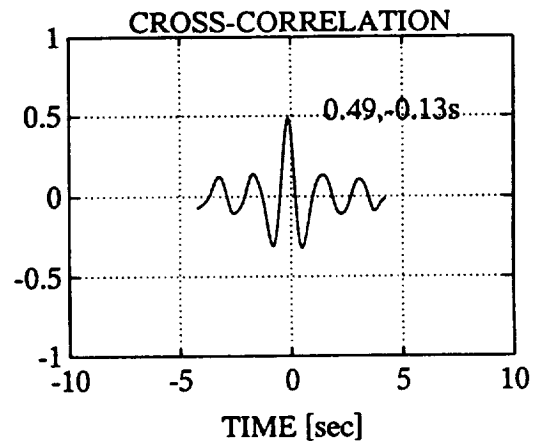
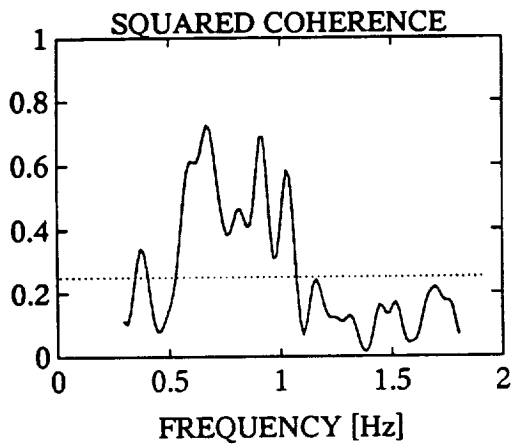
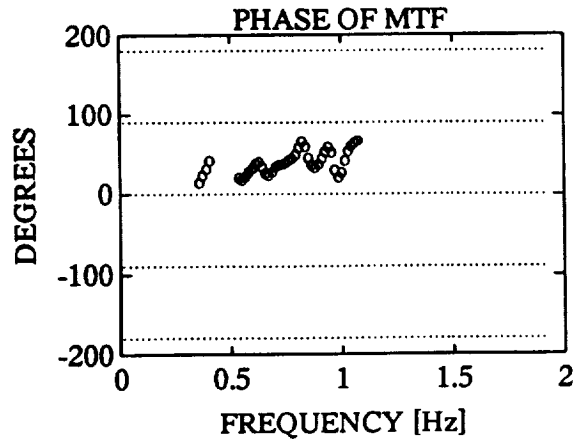
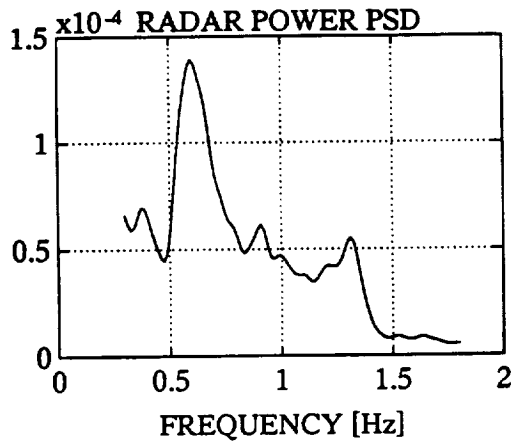
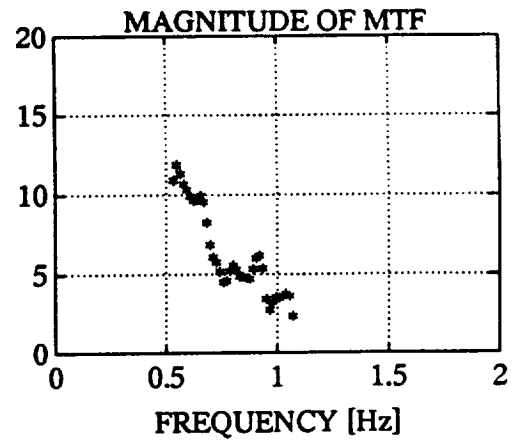
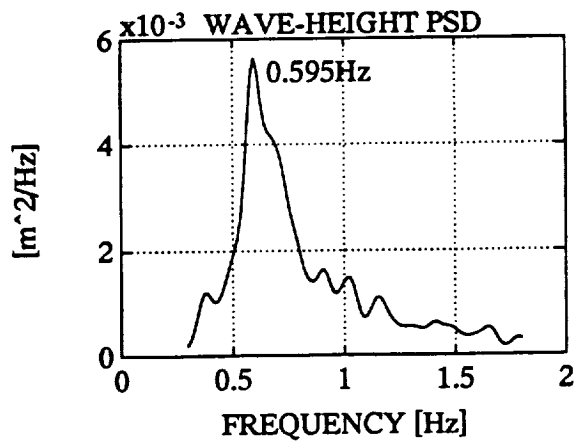
Aug. 4, 1989, Run Time : 17:35:50, Run # 18, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



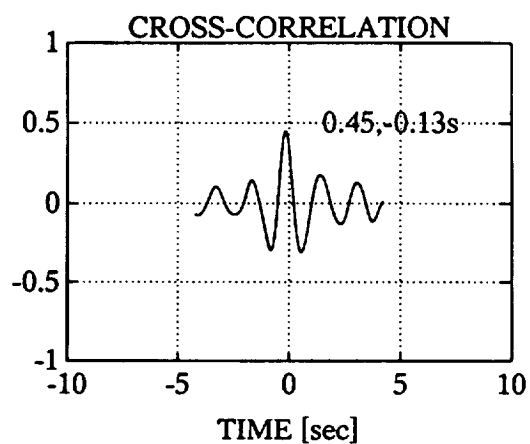
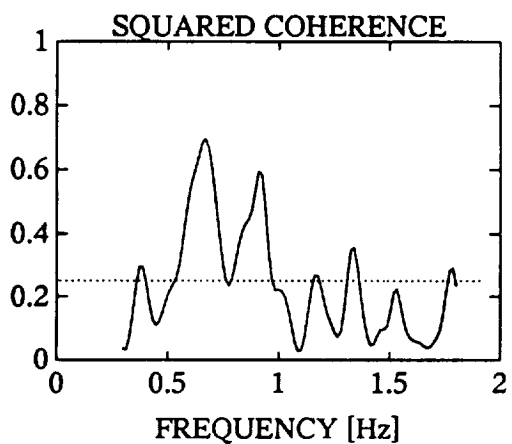
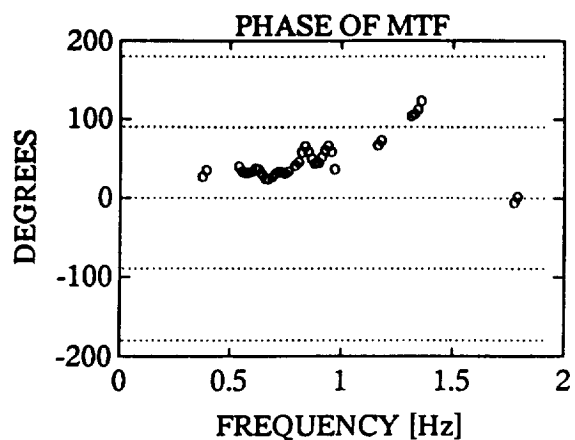
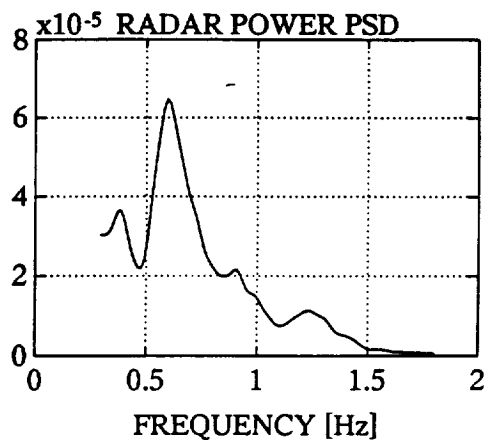
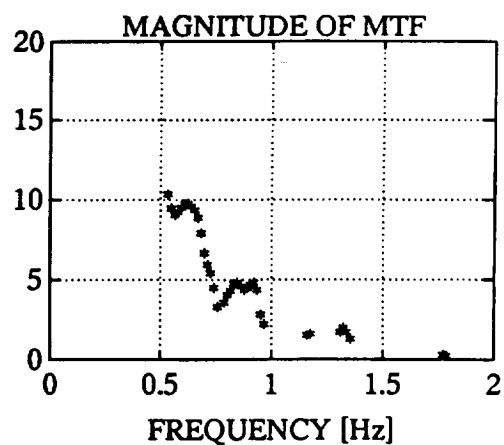
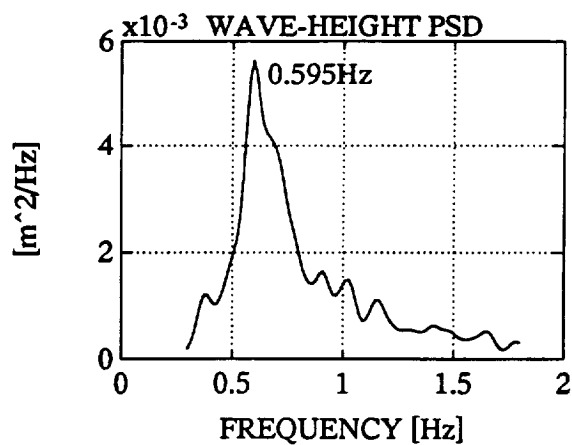
Aug. 4, 1989, Run Time : 17:46:58, Run # 20, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



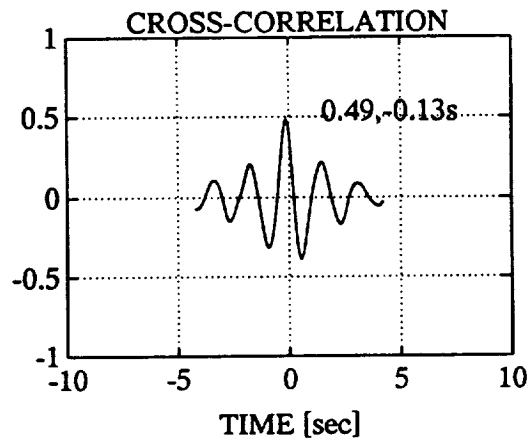
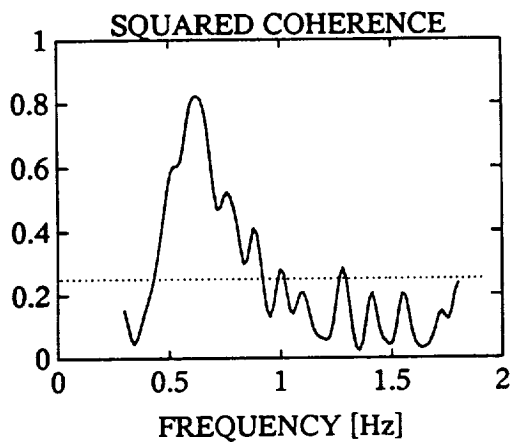
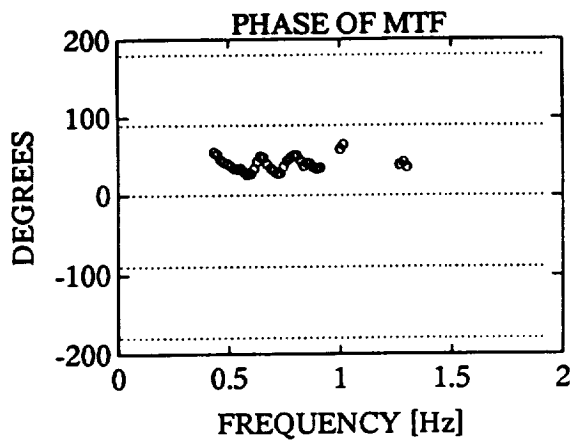
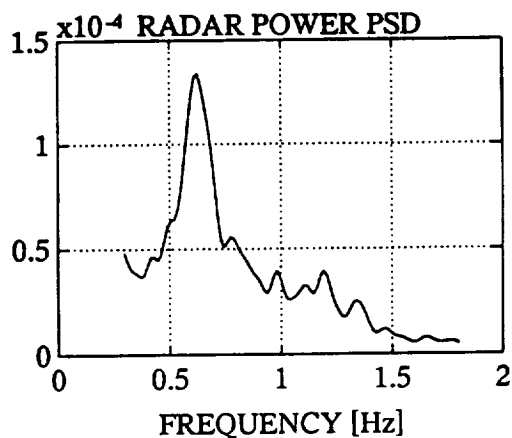
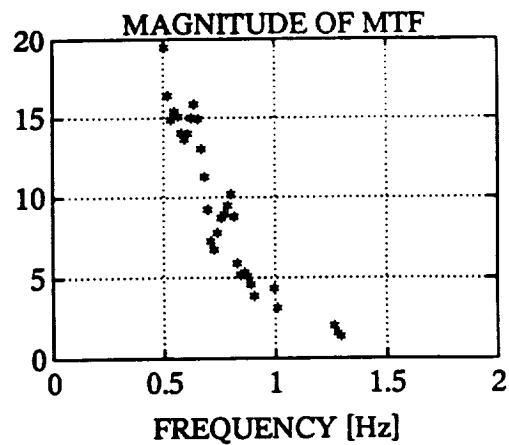
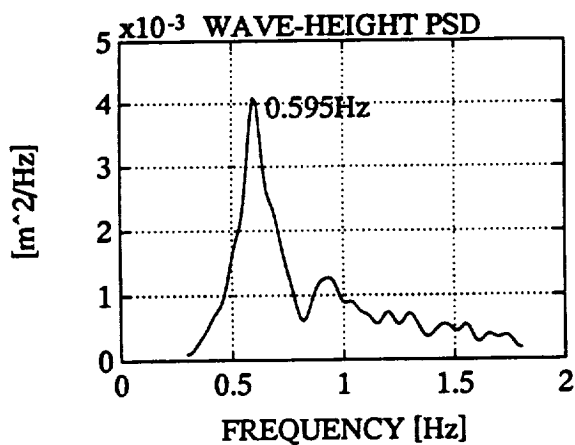
Aug. 4, 1989, Run Time : 17:46:58, Run # 20, C Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



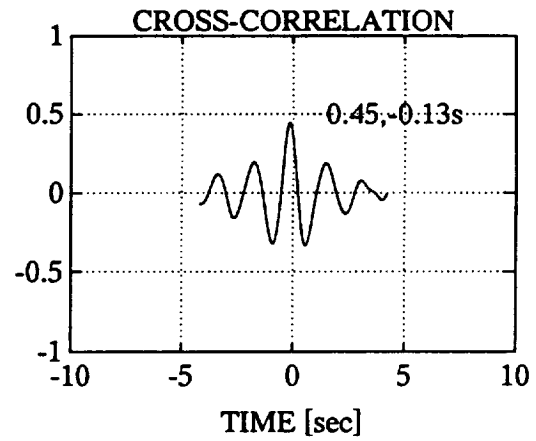
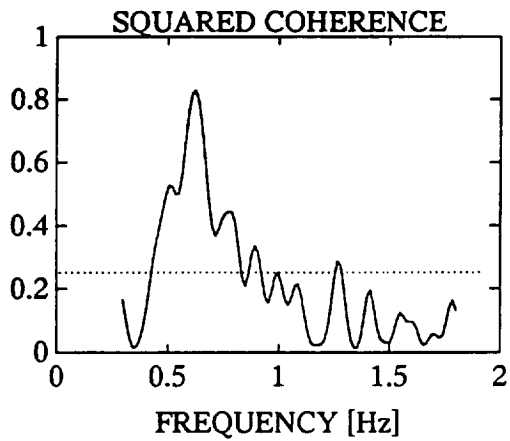
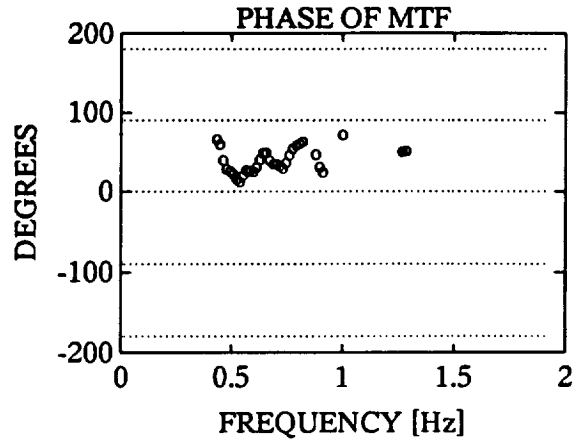
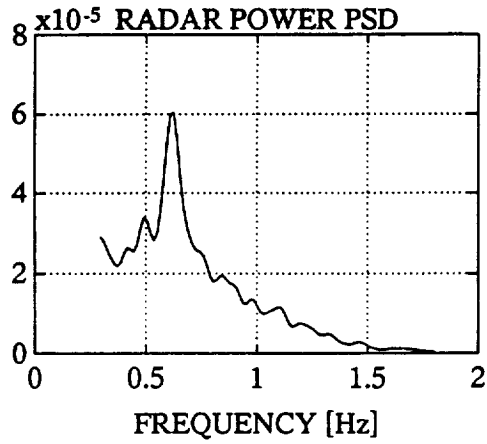
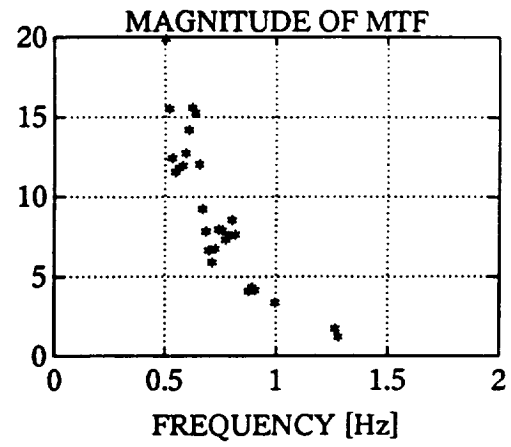
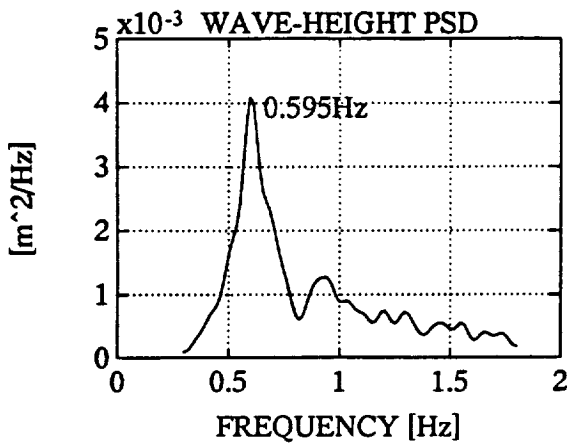
Aug. 4, 1989, Run Time : 17:53:50, Run # 21, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.75 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



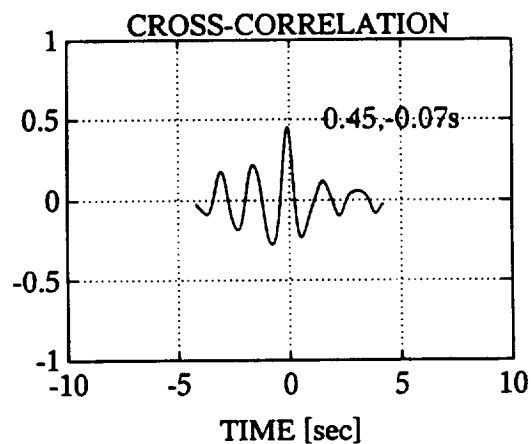
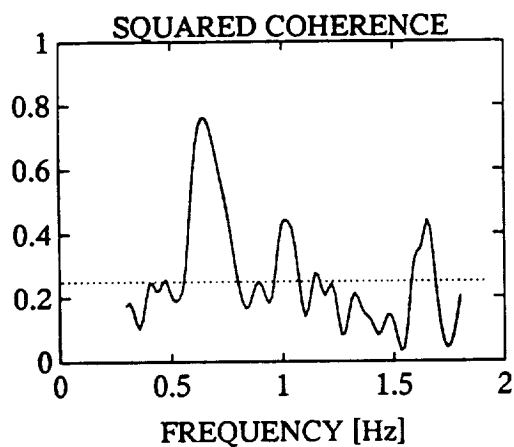
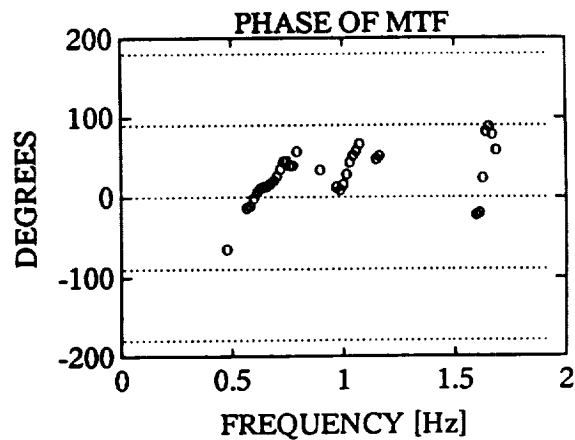
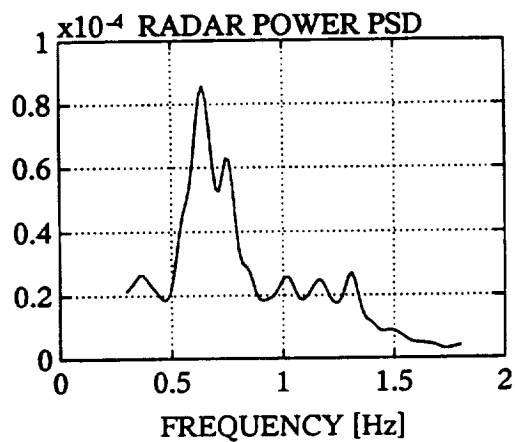
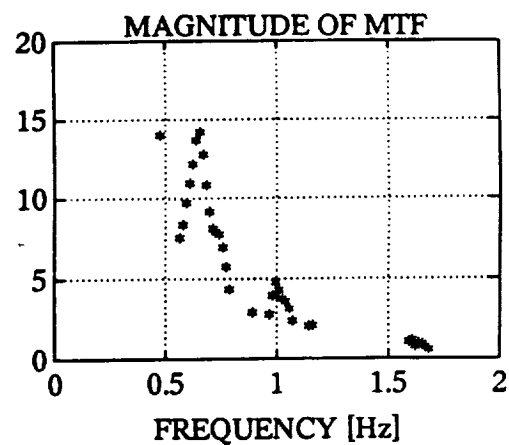
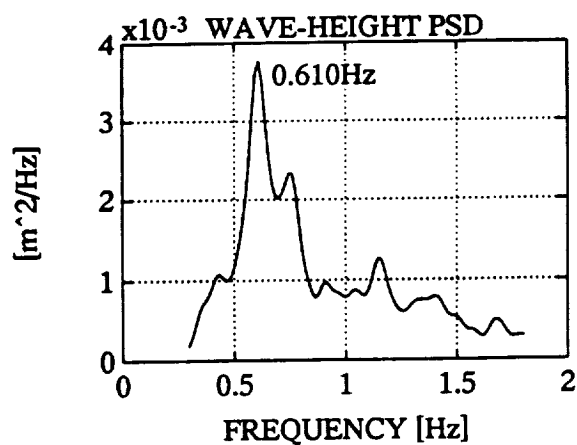
Aug. 4, 1989, Run Time : 17:53:50, Run # 21, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.75 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



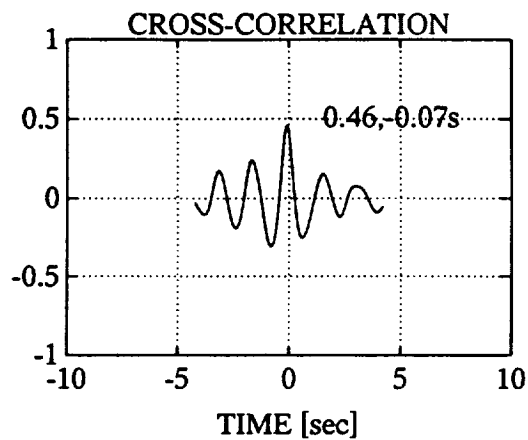
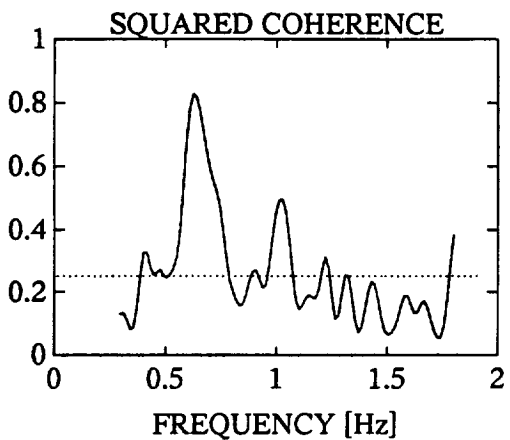
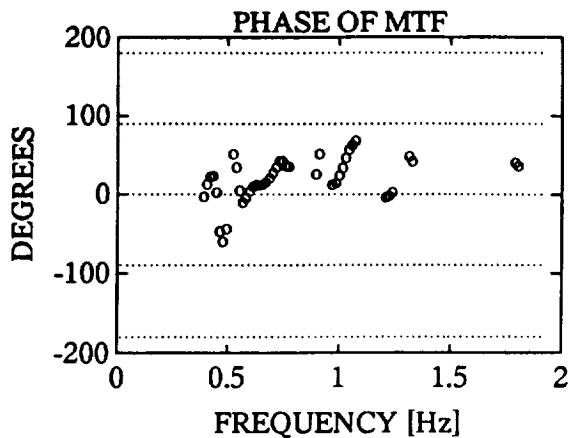
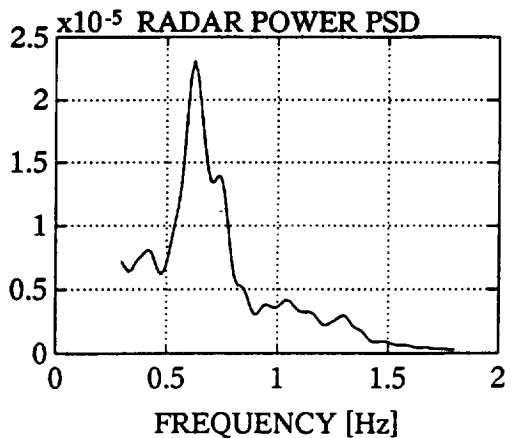
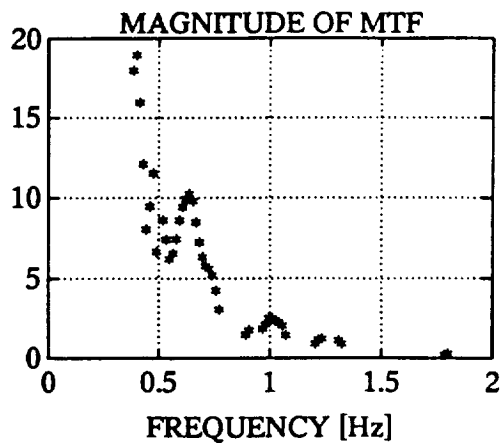
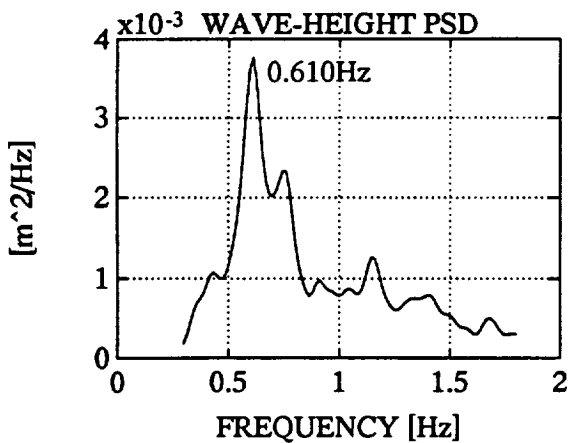
Aug. 4, 1989, Run Time : 18: 5:40, Run # 23, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.61 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



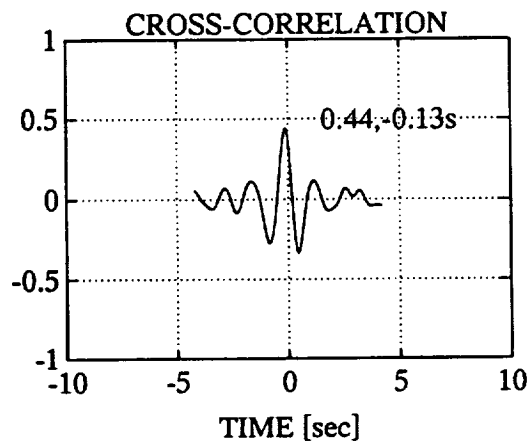
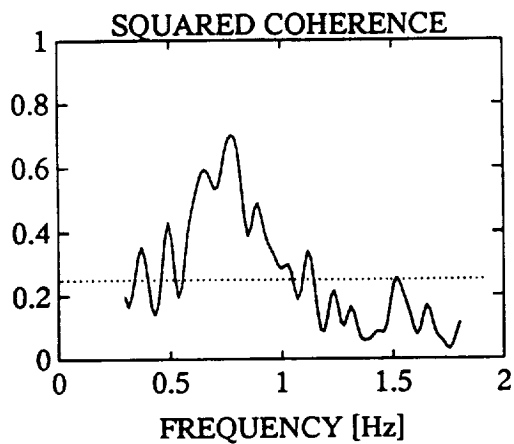
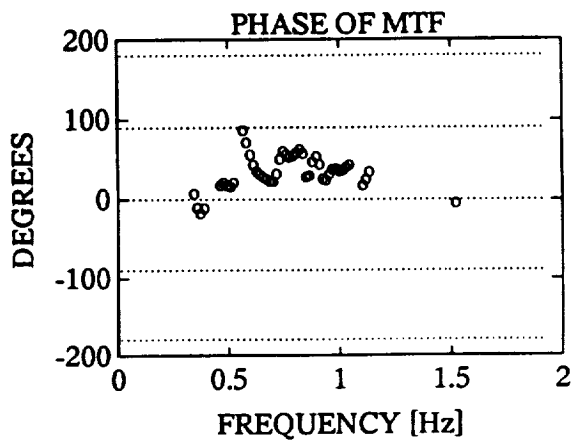
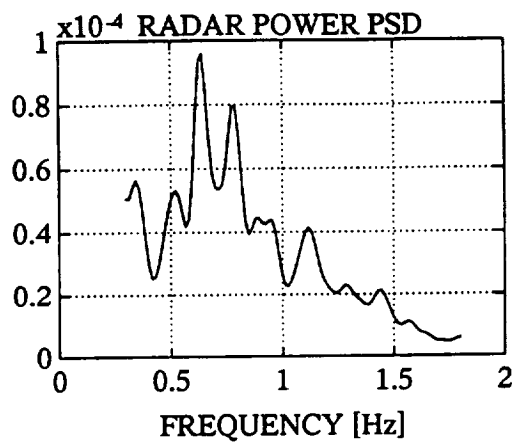
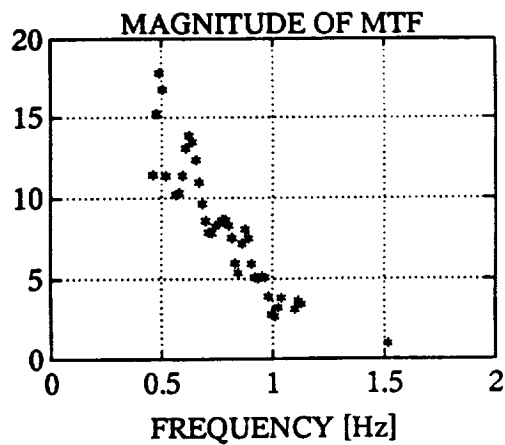
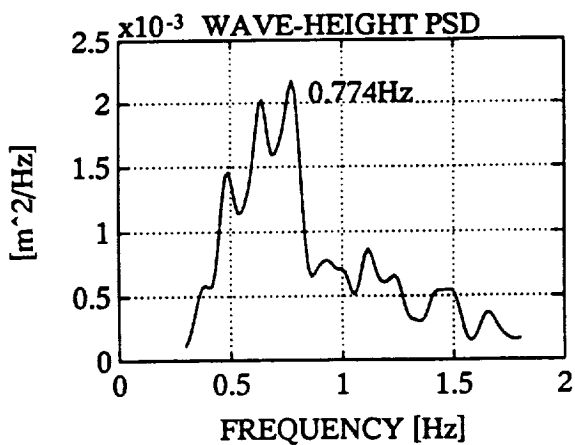
Aug. 4, 1989, Run Time : 18: 5:40, Run # 23, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.61 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



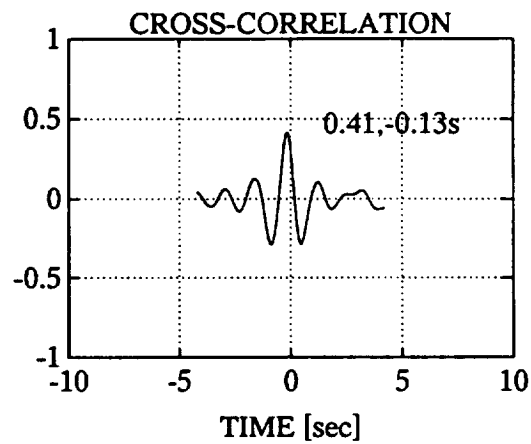
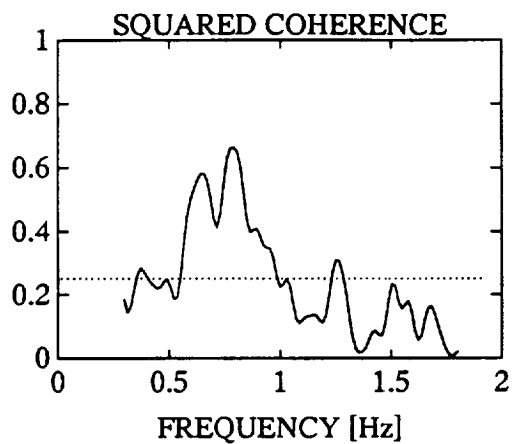
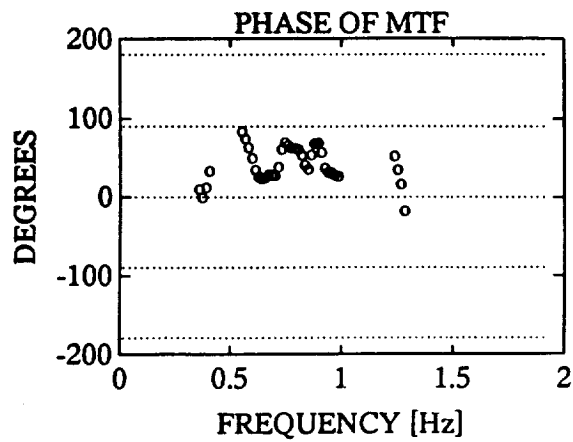
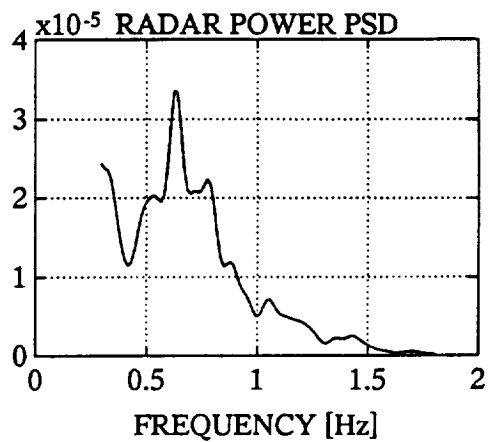
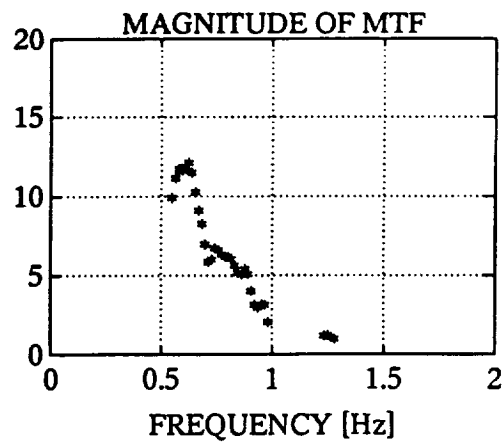
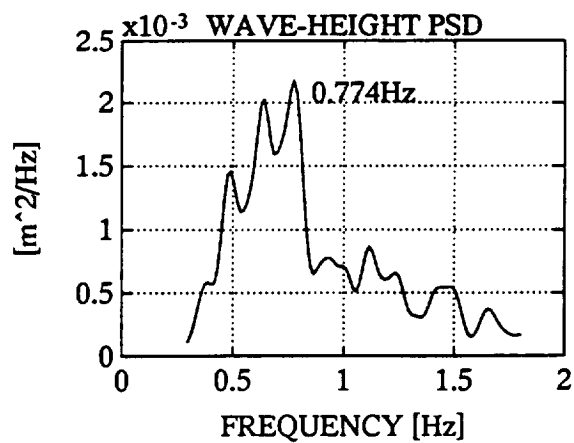
Aug. 4, 1989, Run Time : 18:11: 2, Run # 24, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.26 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



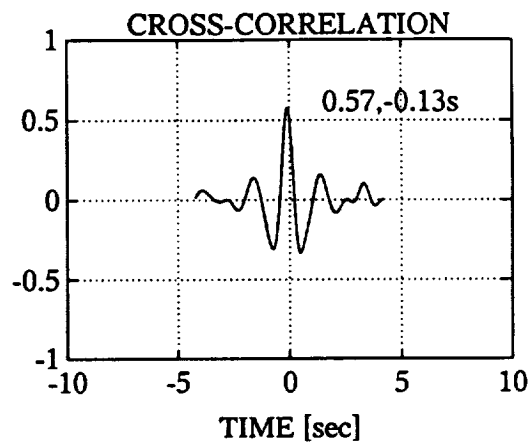
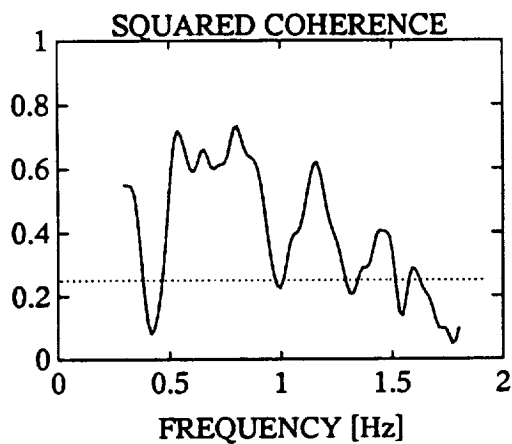
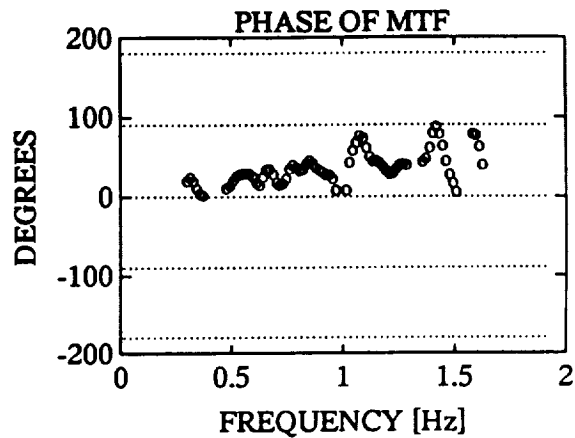
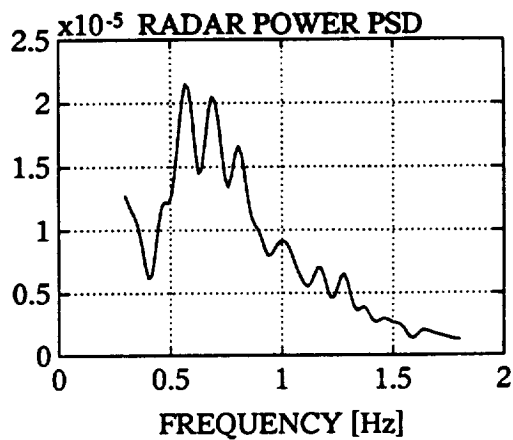
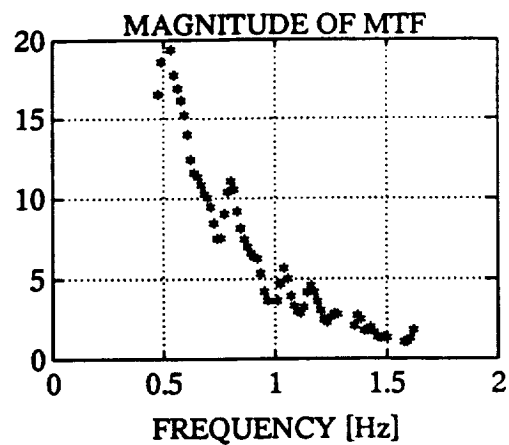
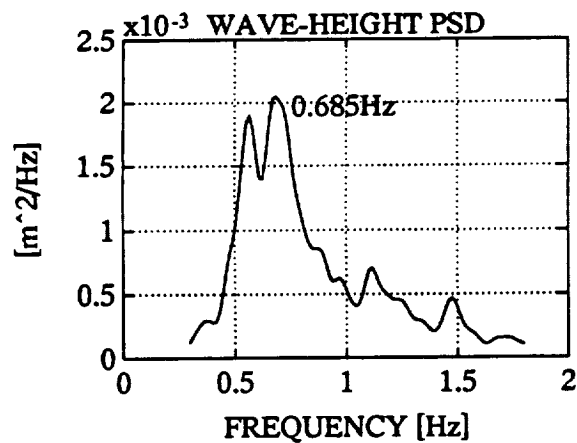
Aug. 4, 1989, Run Time : 18:11:2, Run # 24, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.26 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



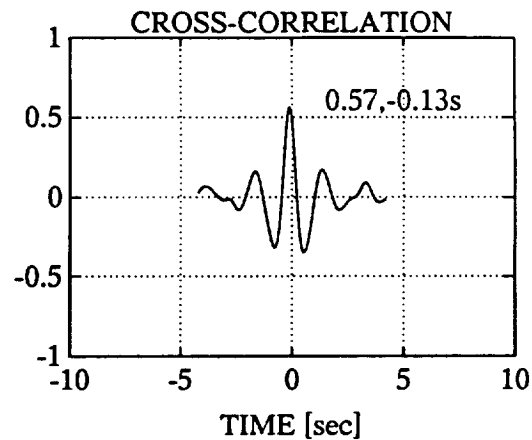
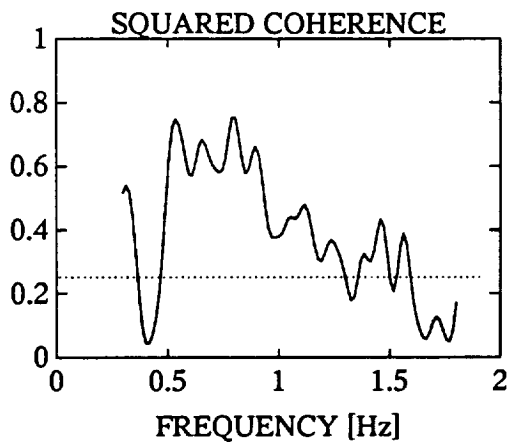
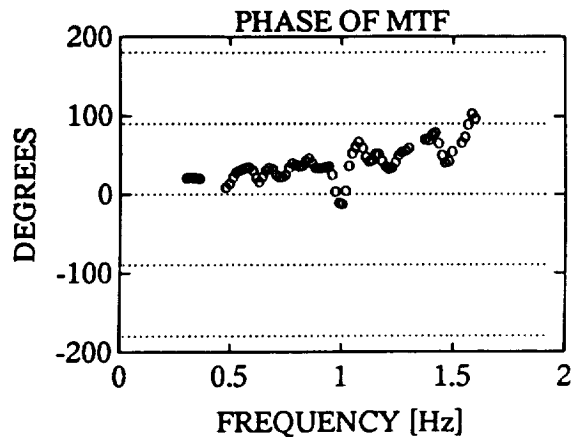
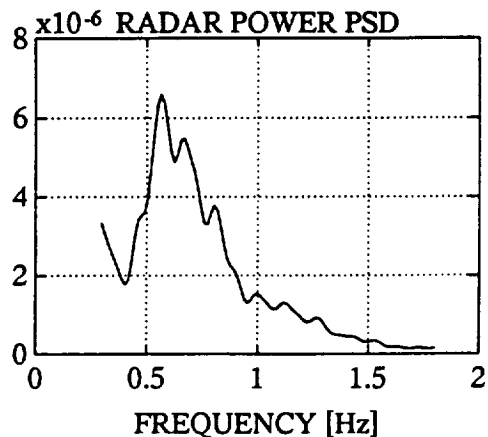
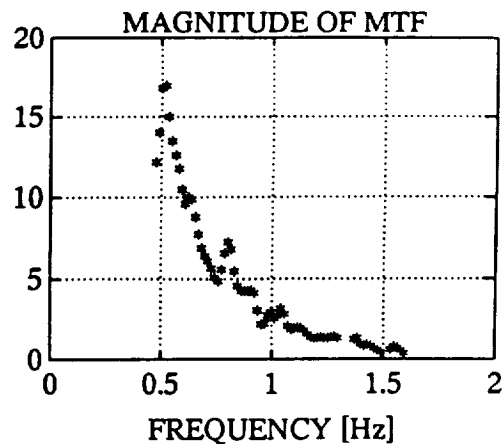
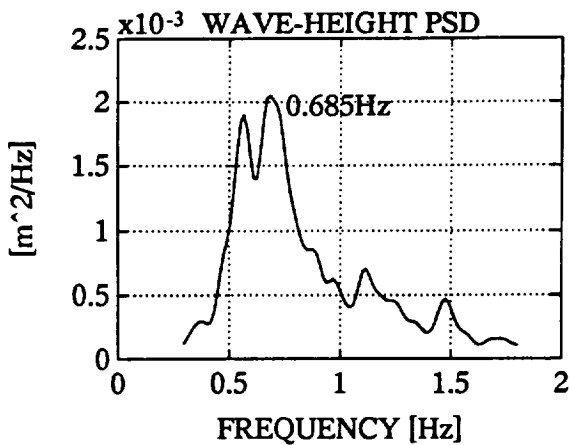
Aug. 4, 1989, Run Time : 18:41:28, Run # 29, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



Aug. 4, 1989, Run Time : 18:41:28, Run # 29, C Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)

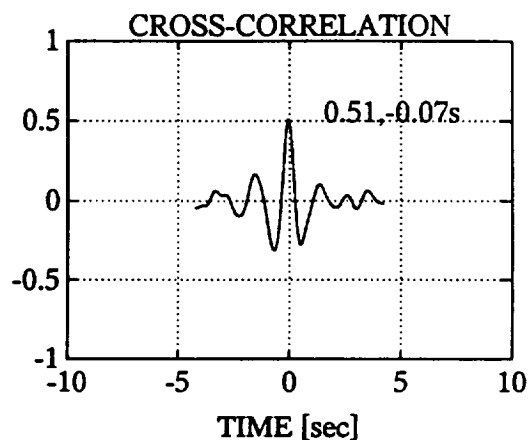
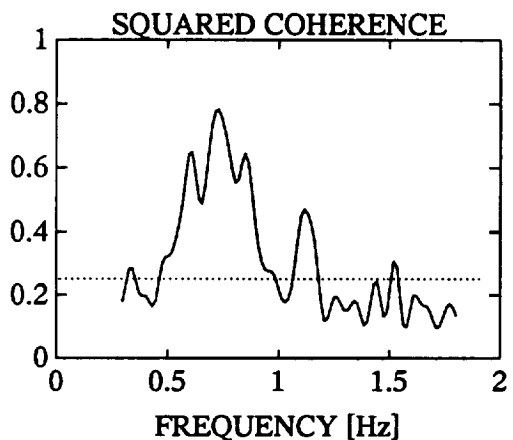
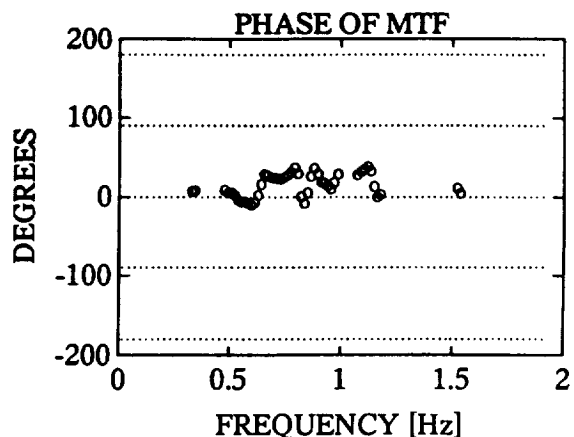
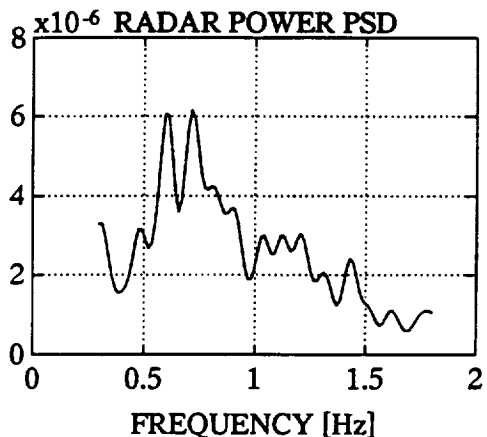
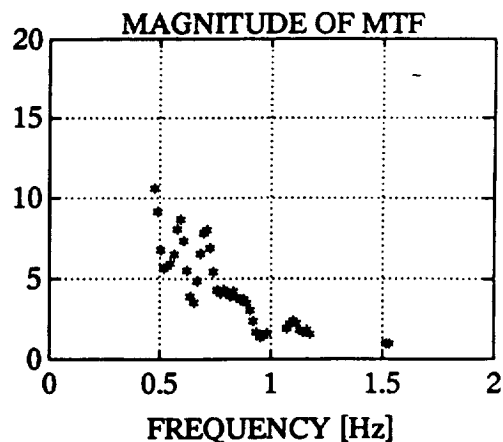
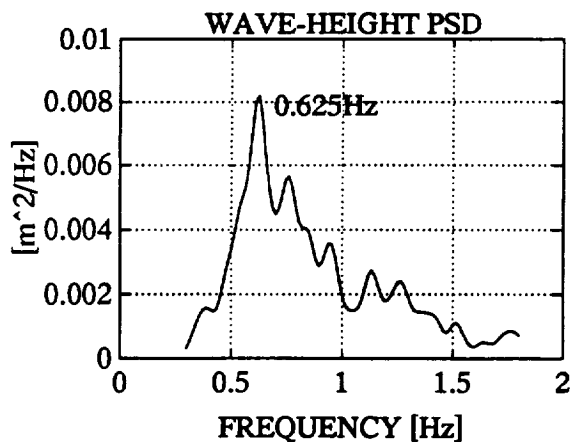


Aug. 7, 1989, Run Time : 18:39:40, Run # 13, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.46 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present

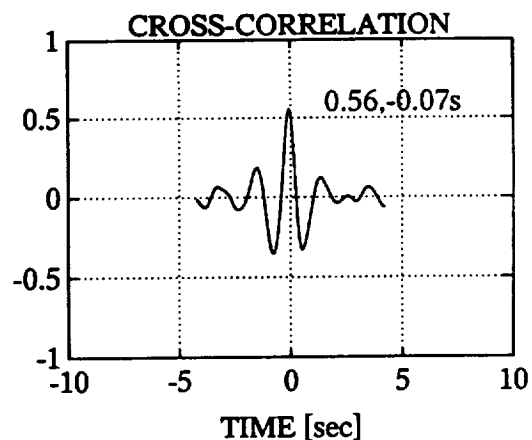
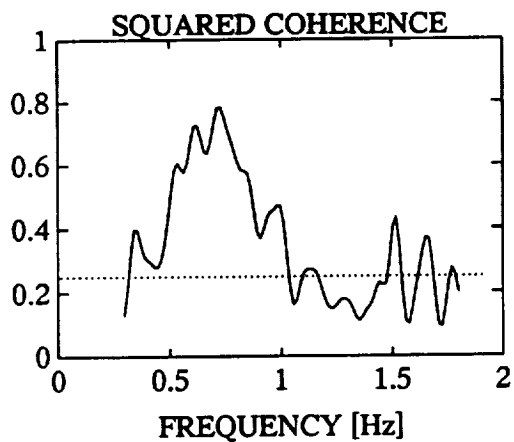
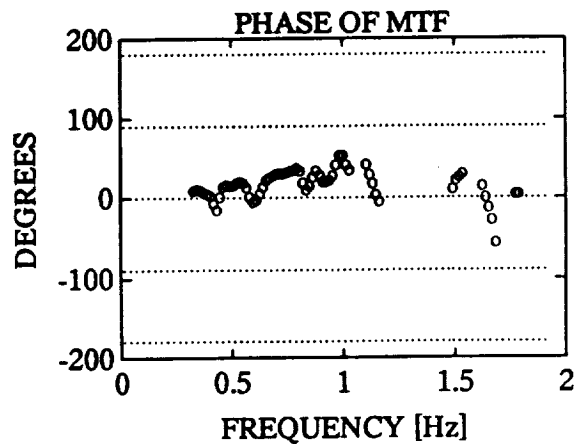
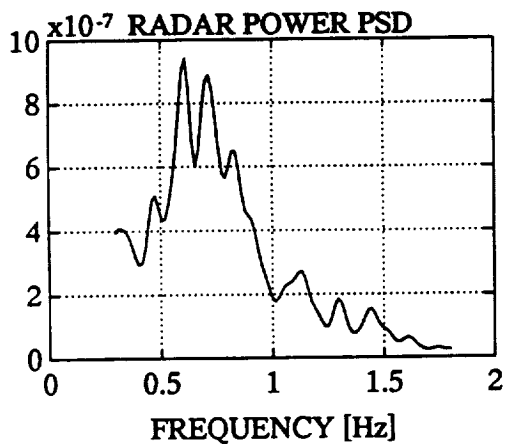
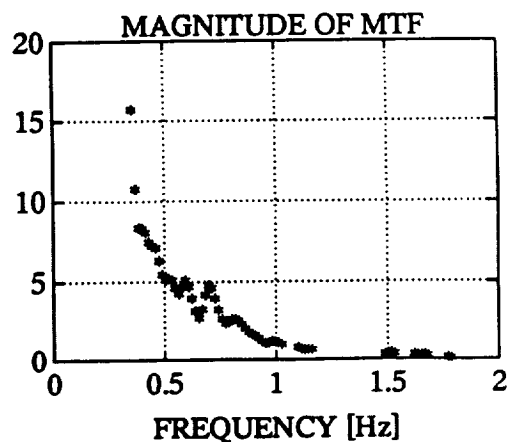
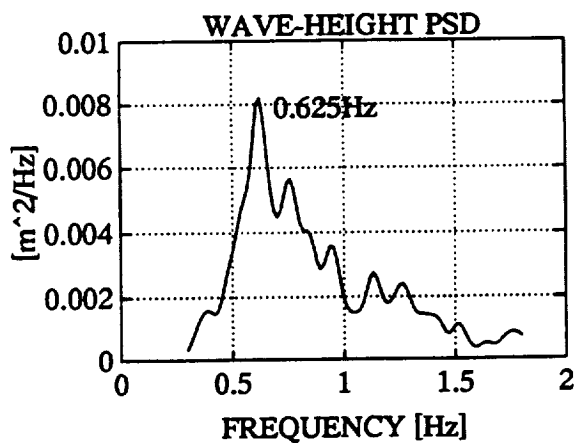


Aug. 7, 1989, Run Time : 18:39:40, Run # 13, C Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.46 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)

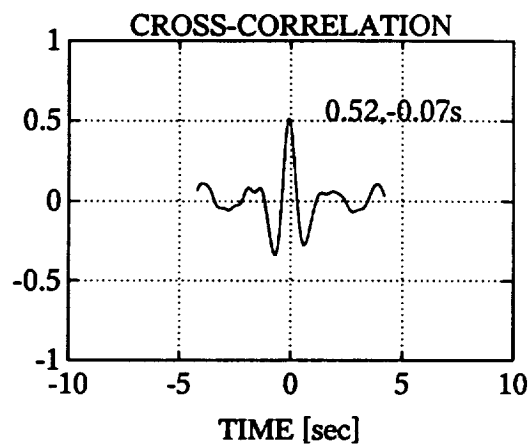
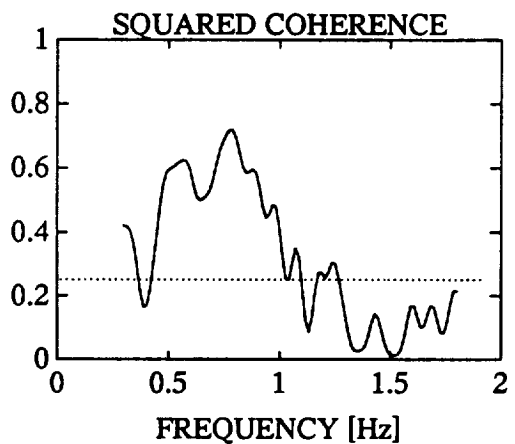
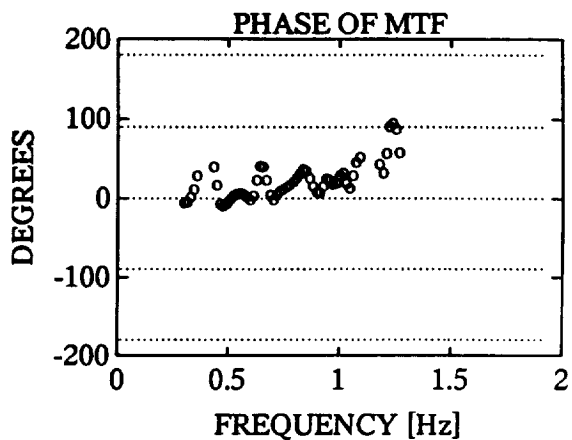
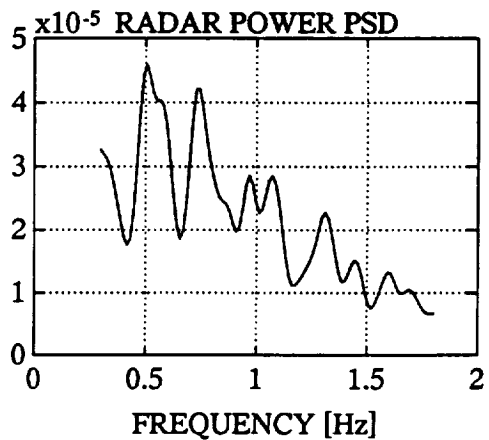
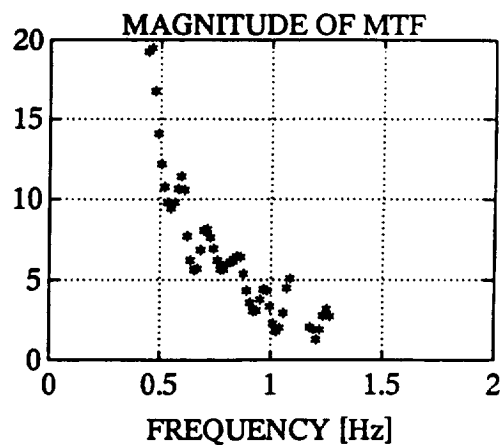
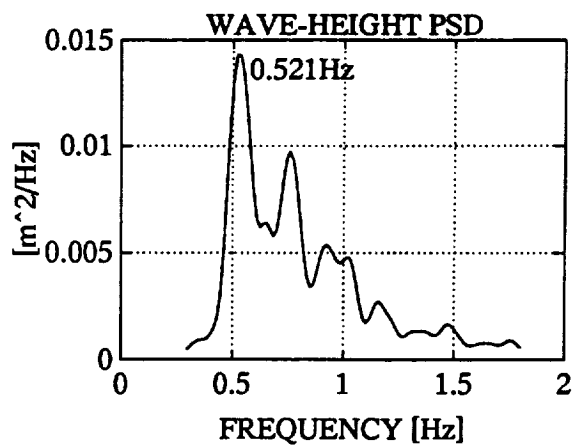
C-2. X Band



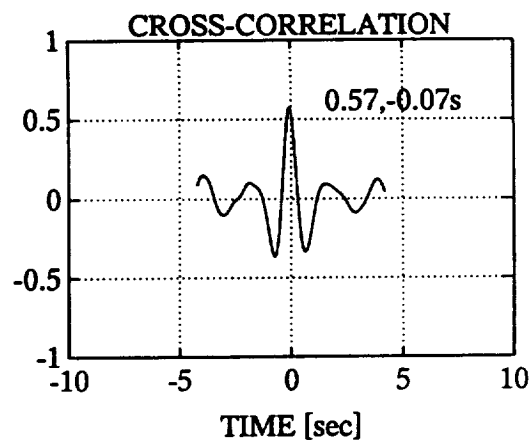
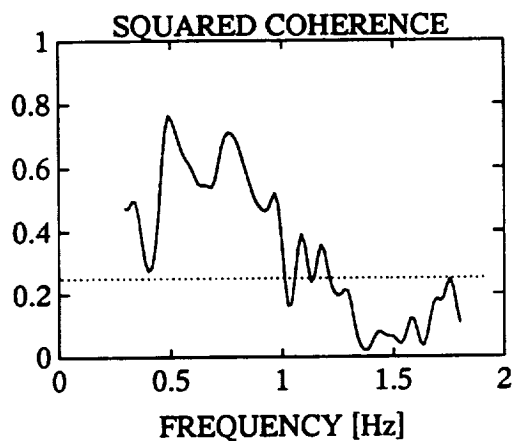
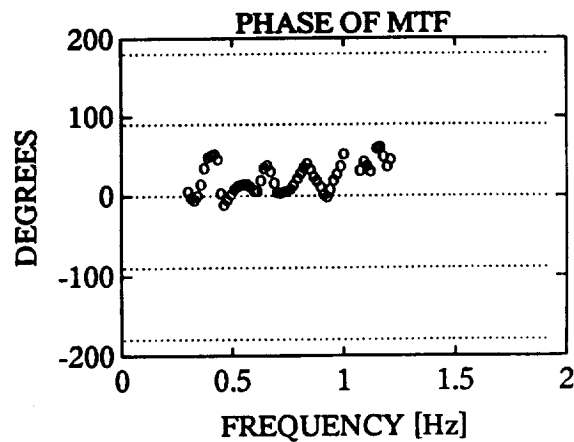
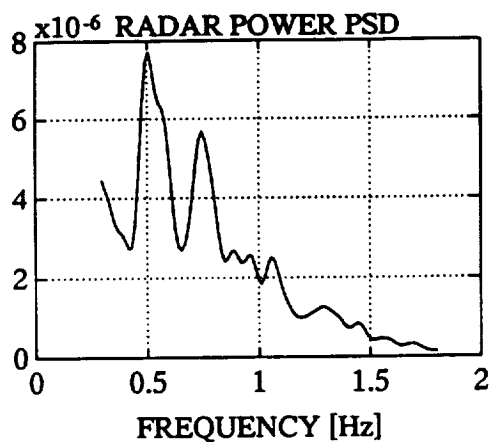
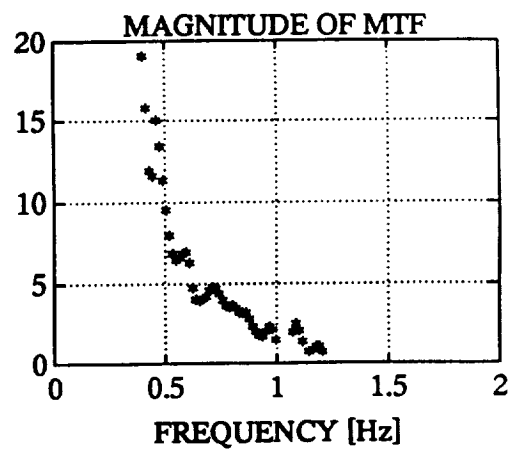
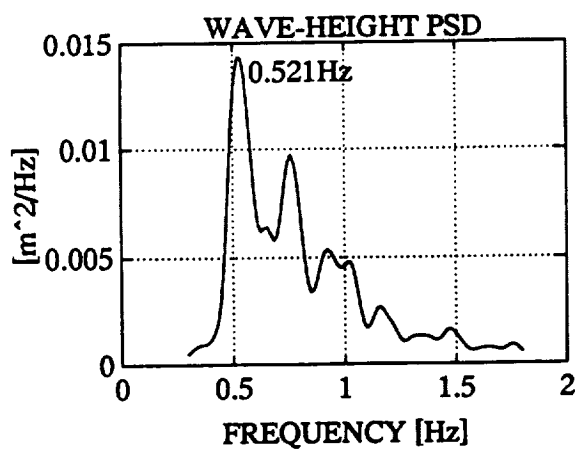
July 19, 1989, Run Time : 17:25:38, Run # 9, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 6.25 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



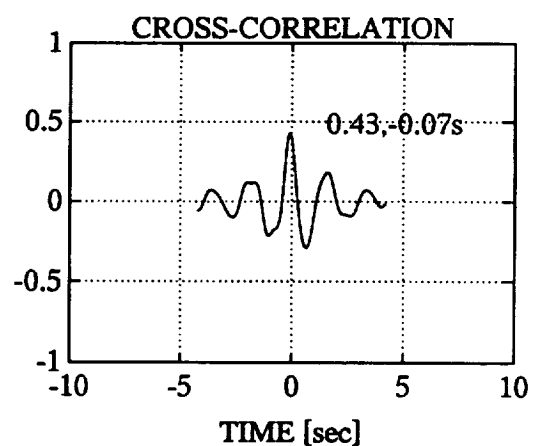
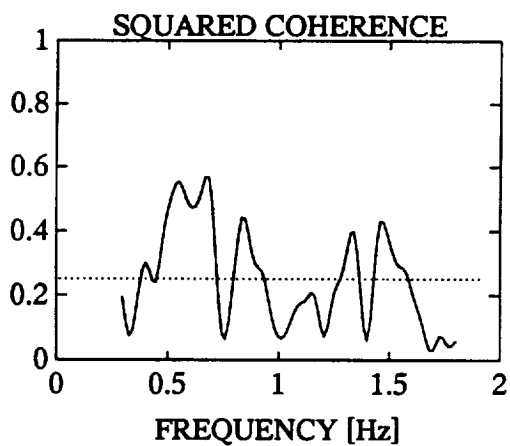
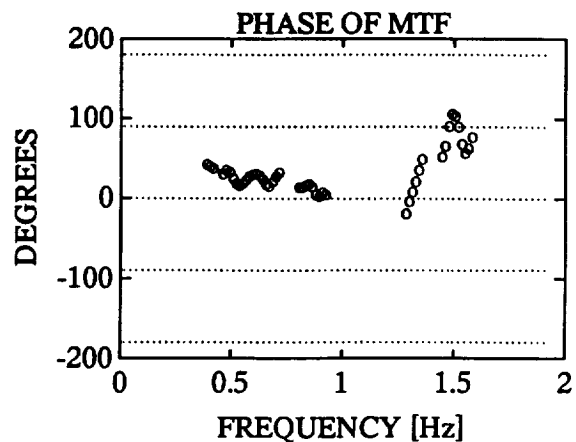
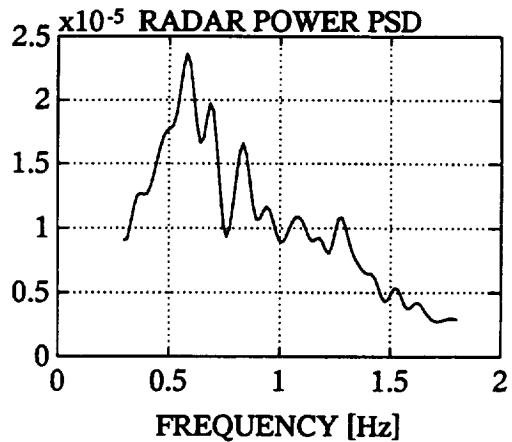
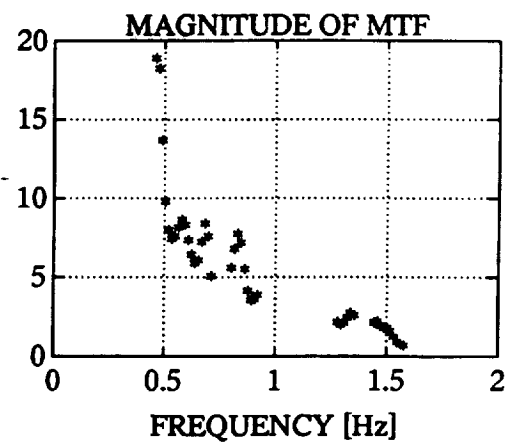
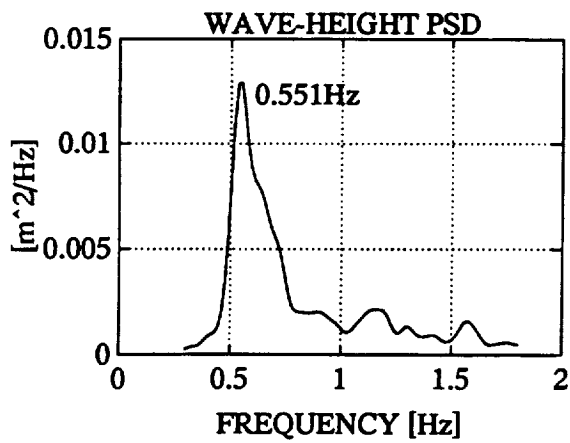
July 19, 1989, Run Time : 17:25:38, Run # 9, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 6.25 m/s, Air Temp. : 21.9 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



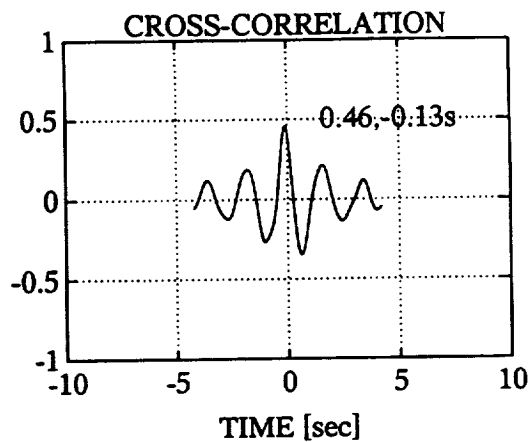
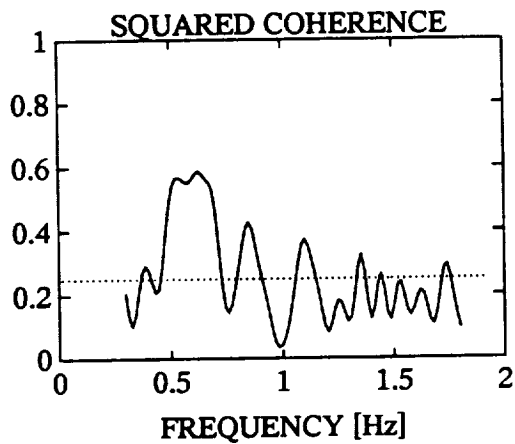
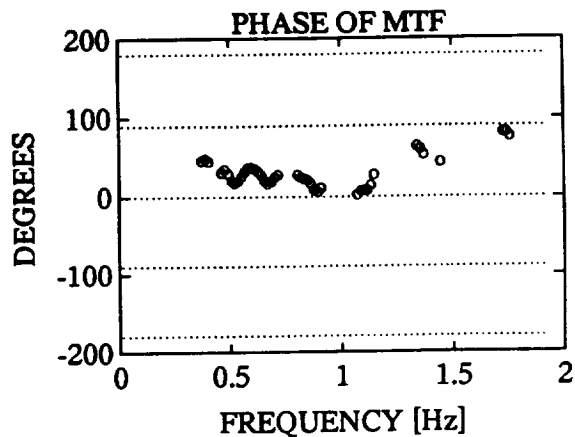
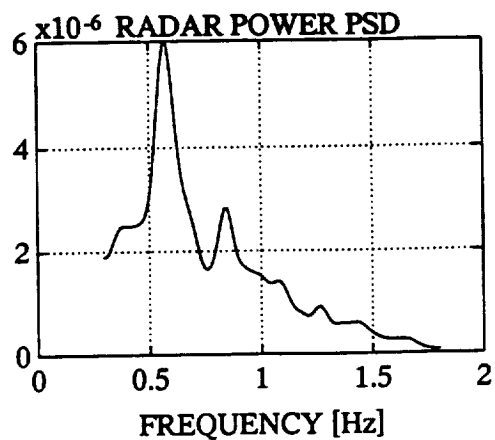
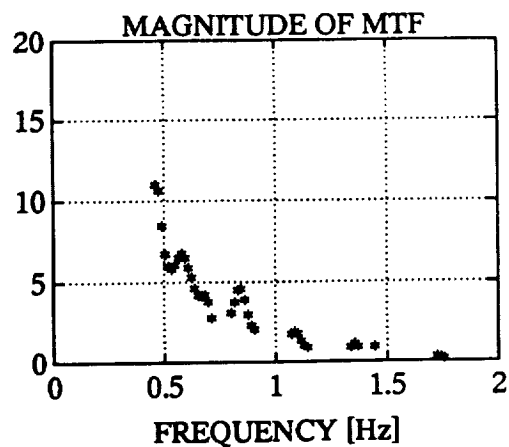
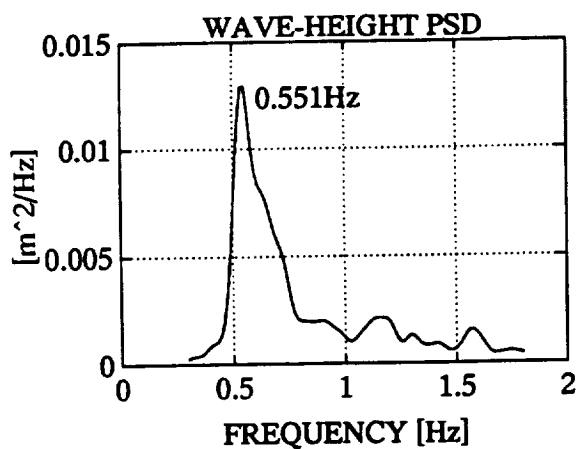
July 19, 1989, Run Time : 17:55: 7, Run # 13, X Band, HH Polarization, 40.0 deg. Incidence
 WindSpeed : 6.56 m/s, Air Temp. : 21.1 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



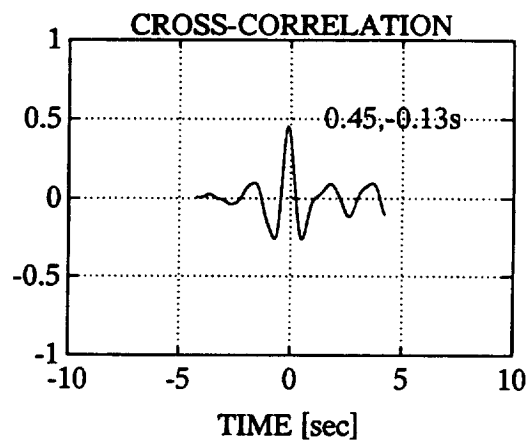
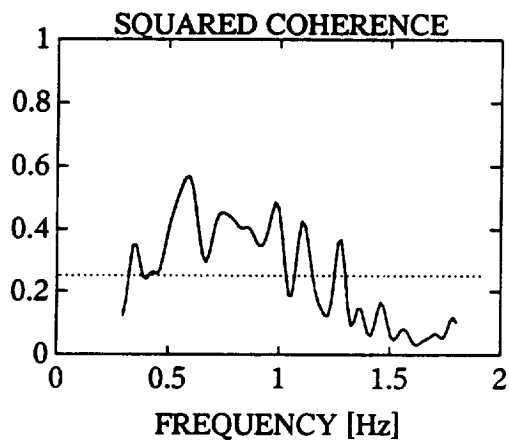
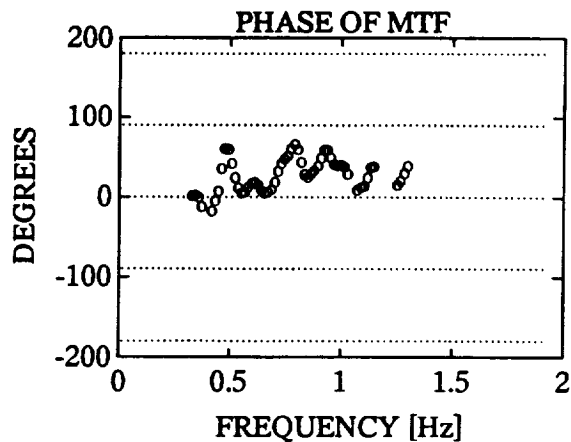
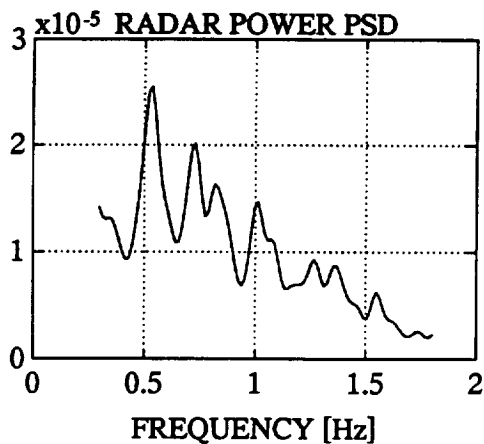
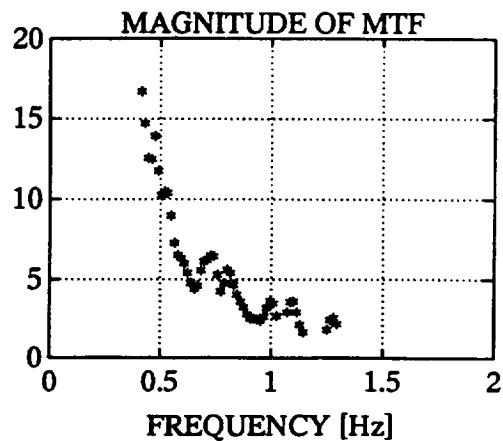
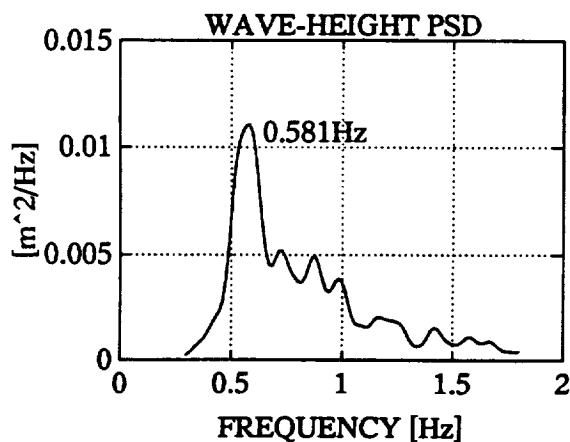
July 19, 1989, Run Time : 17:55: 7, Run # 13, X Band, HH Polarization, 40.0 deg. Incidence
 WindSpeed : 6.56 m/s, Air Temp. : 21.1 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



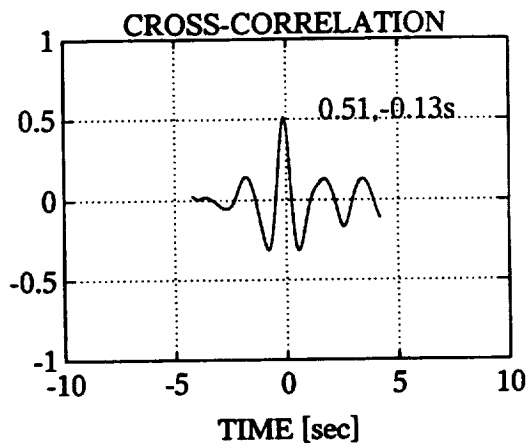
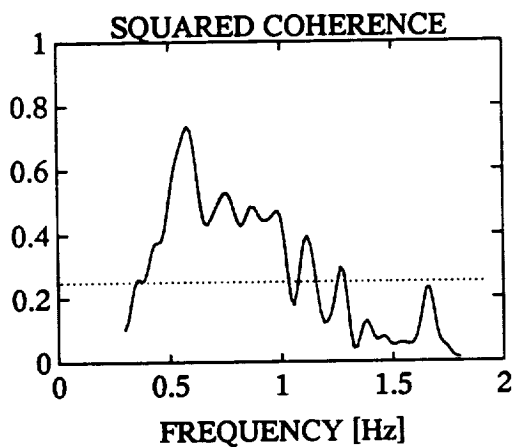
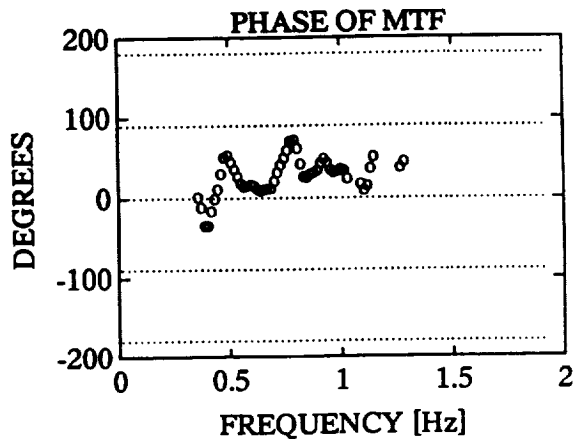
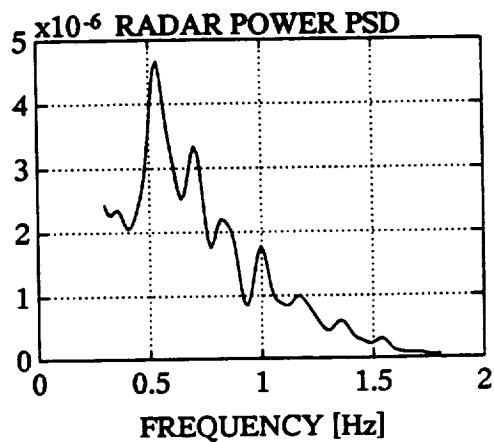
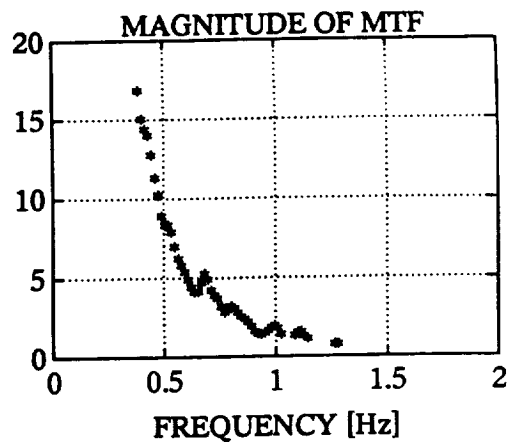
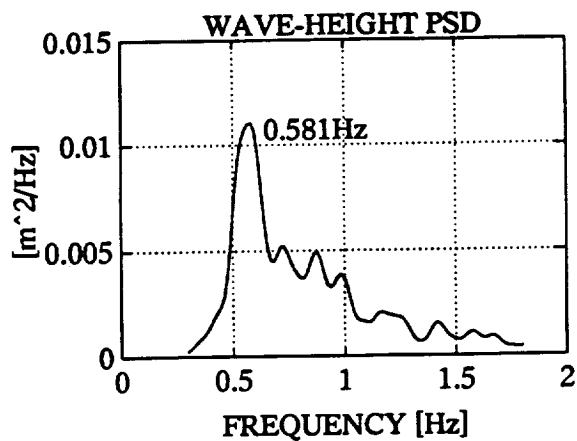
July 19, 1989, Run Time : 18:17:25, Run # 16, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 7.01 m/s, Air Temp. : 21.5 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



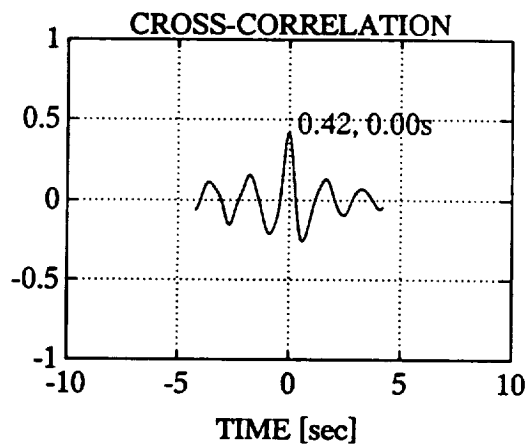
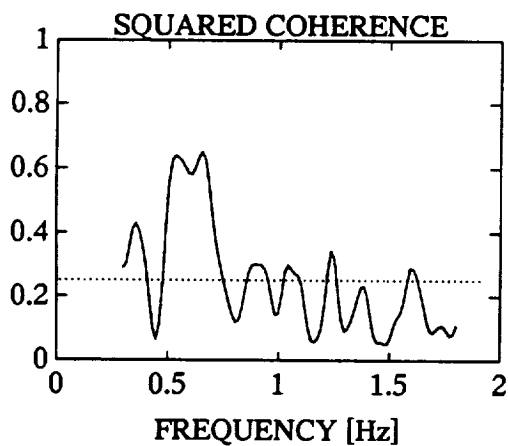
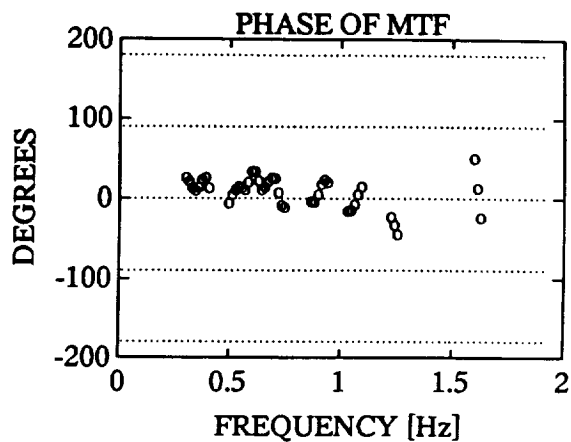
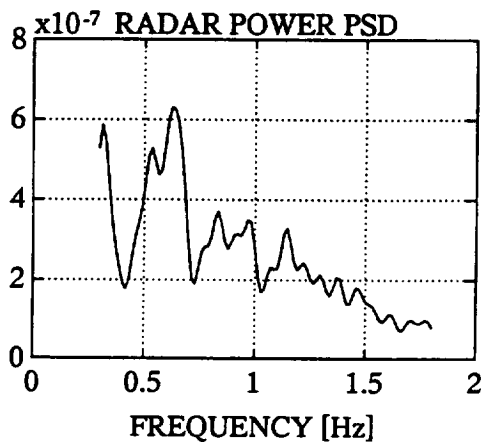
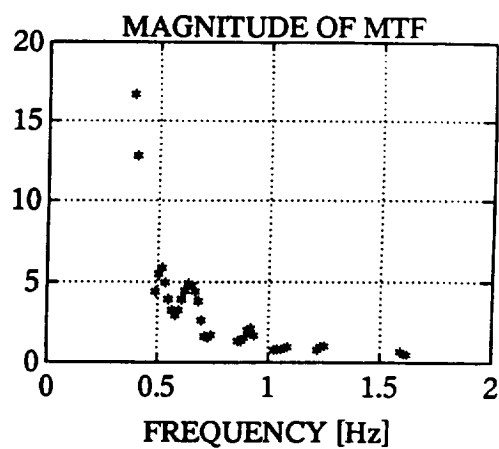
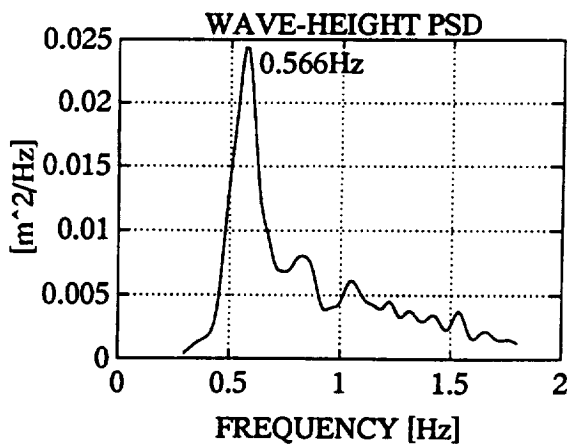
July 19, 1989, Run Time : 18:17:25, Run # 16, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 7.01 m/s, Air Temp. : 21.5 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



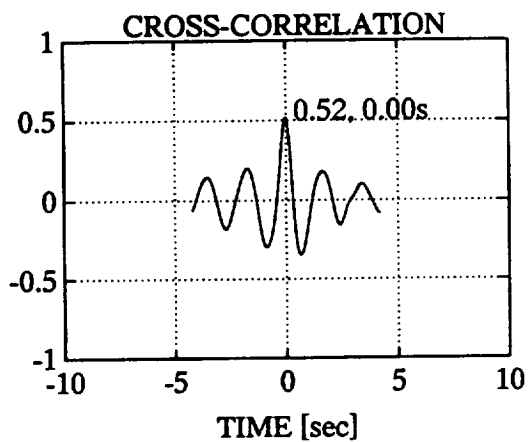
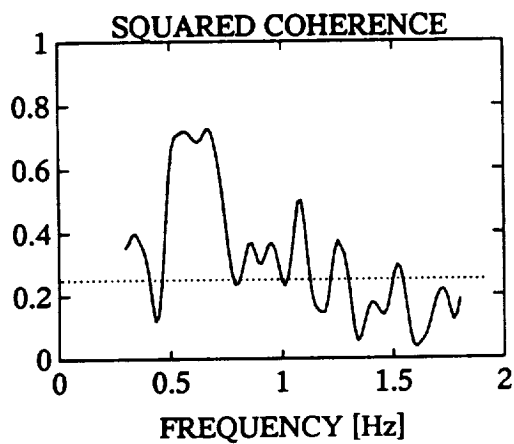
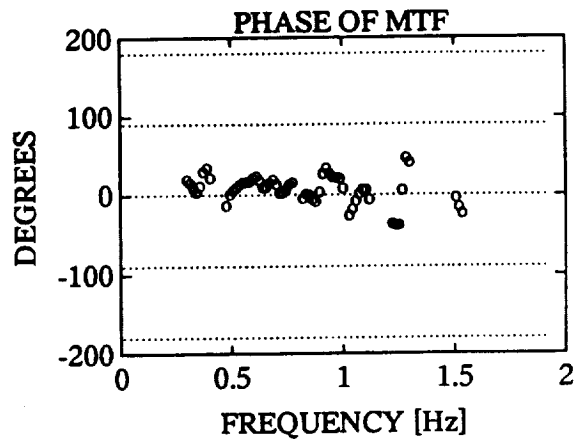
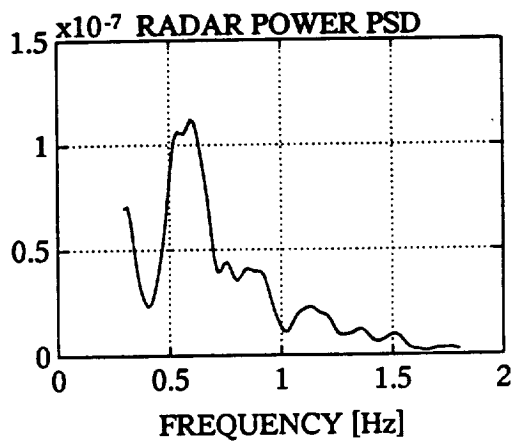
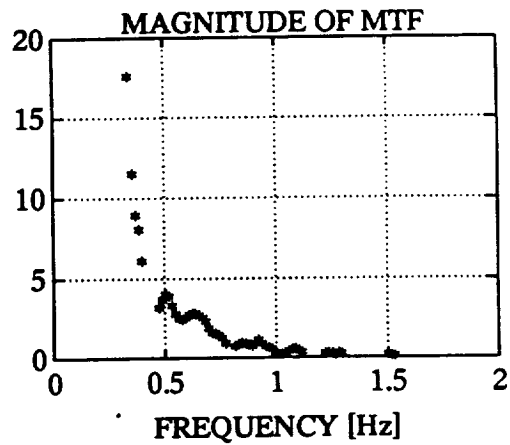
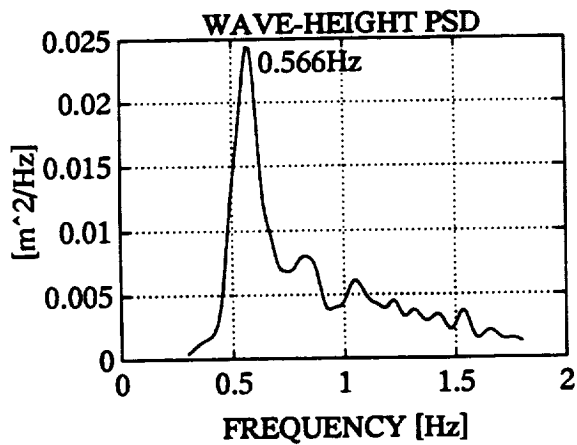
July 19, 1989, Run Time : 18:22:48, Run # 17, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 6.72 m/s, Air Temp. : 21.4 deg C, Water Temp. : 21.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



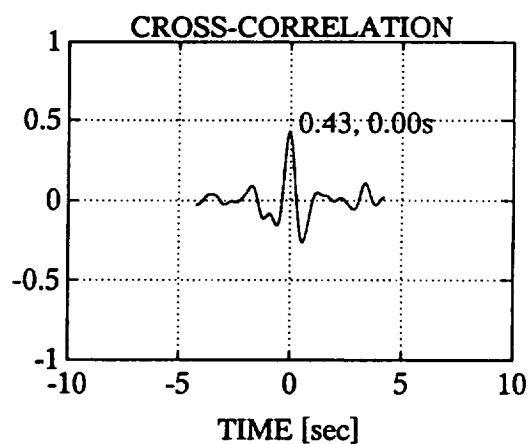
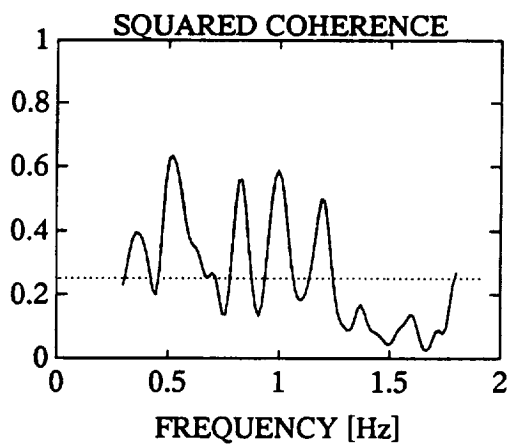
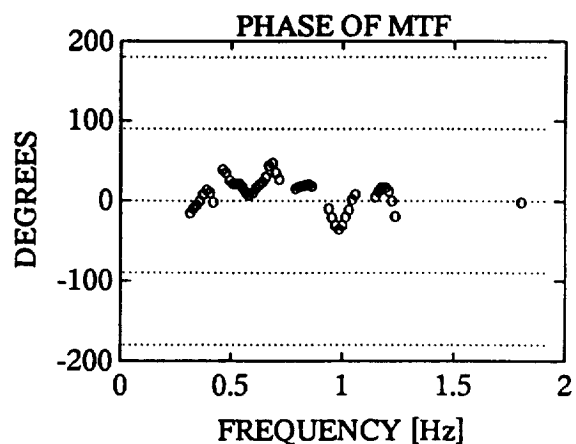
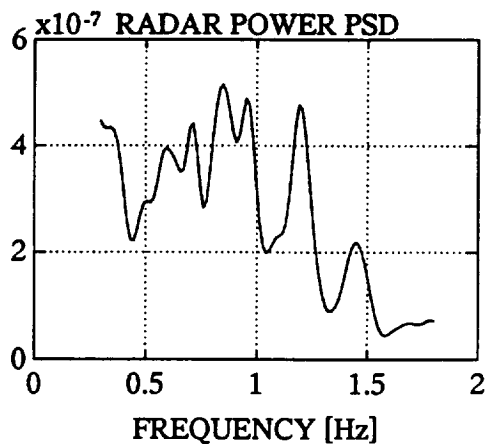
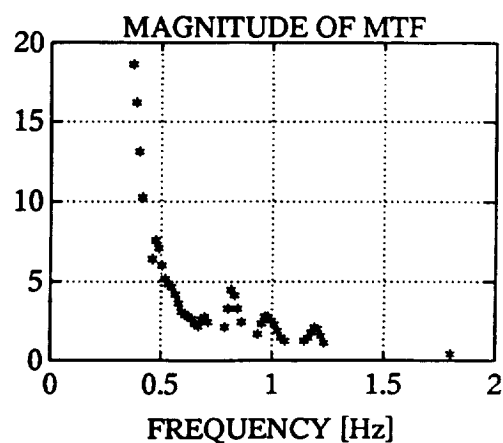
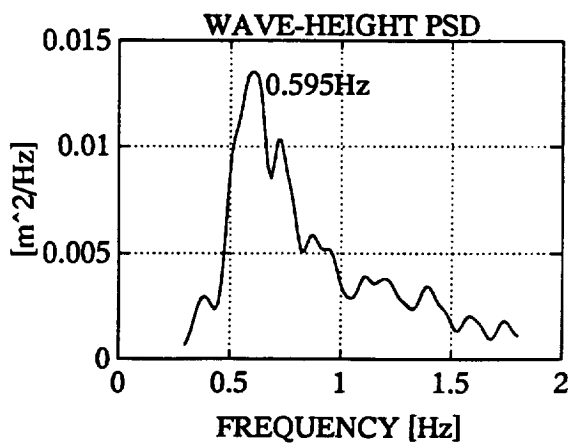
July 19, 1989, Run Time : 18:22:48, Run # 17, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 6.72 m/s, Air Temp. : 21.4 deg C, Water Temp. : 21.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



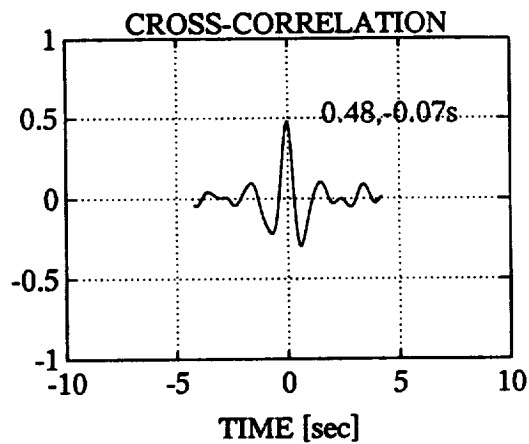
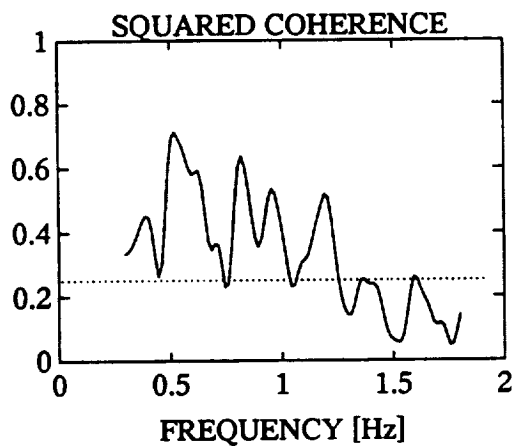
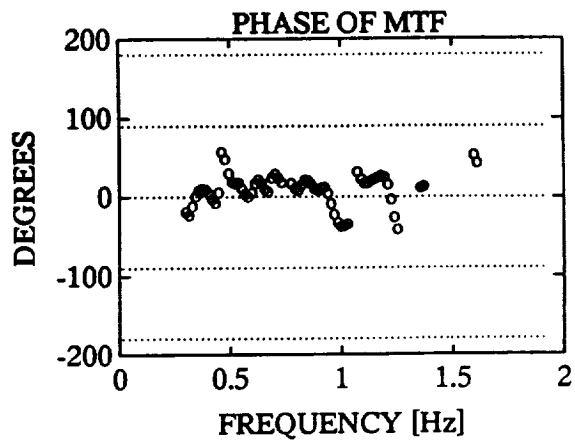
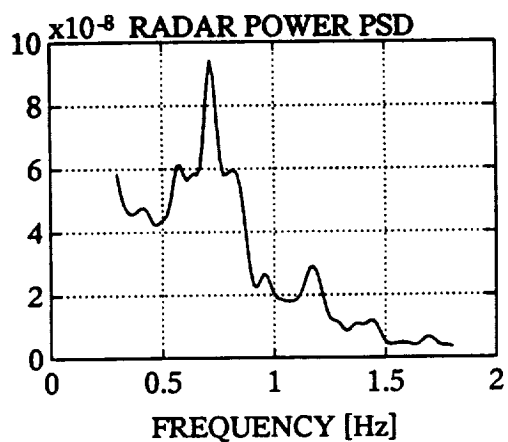
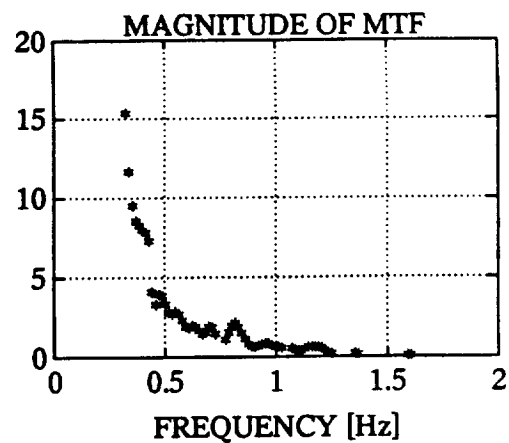
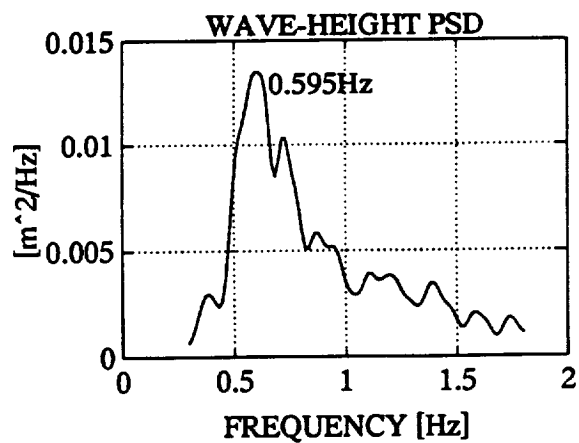
July 19, 1989, Run Time : 19:51: 3, Run # 30, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 5.03 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



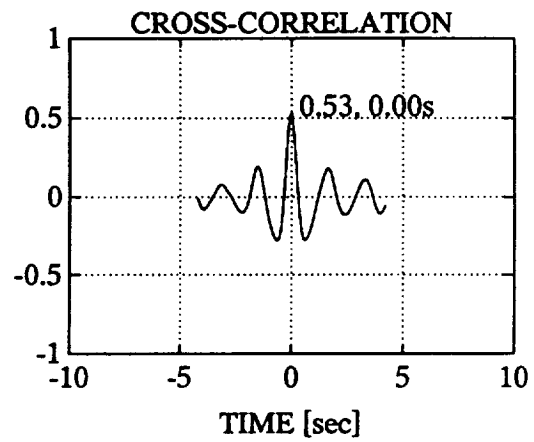
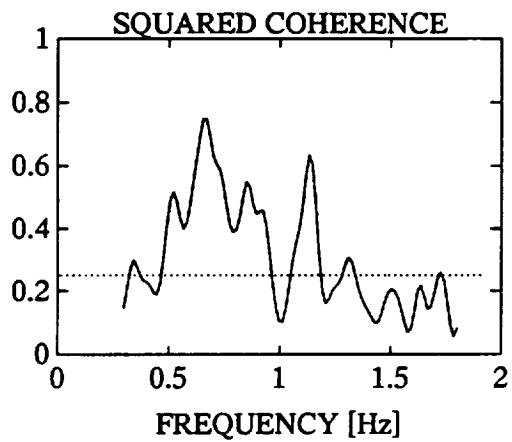
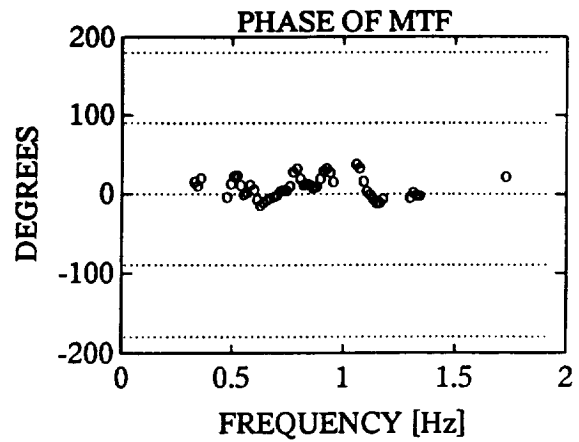
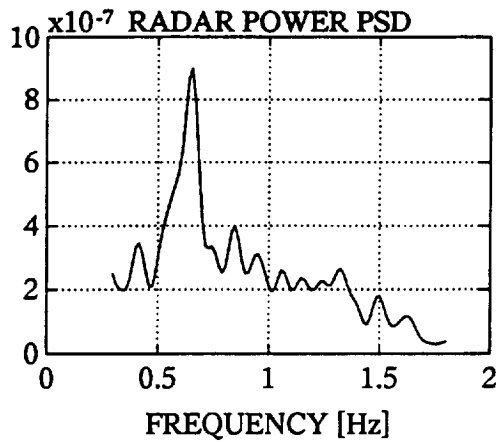
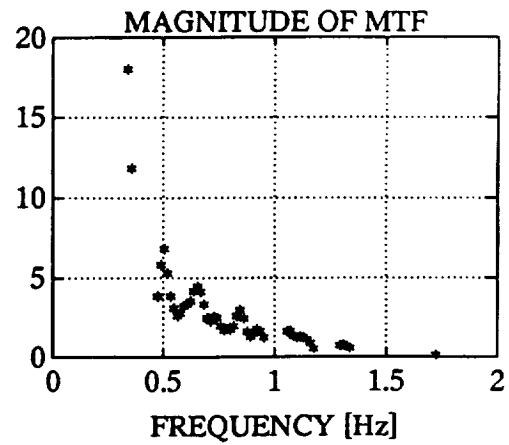
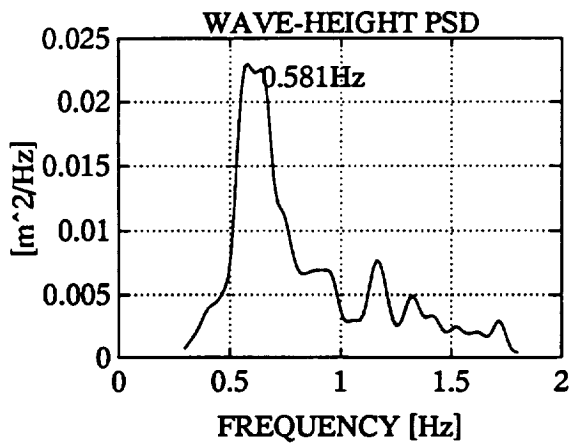
July 19, 1989, Run Time : 19:51: 3, Run # 30, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 5.03 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



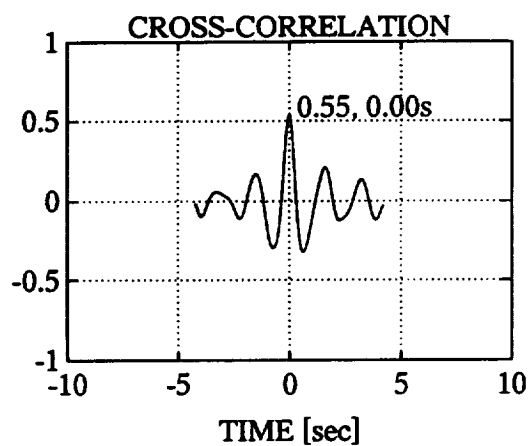
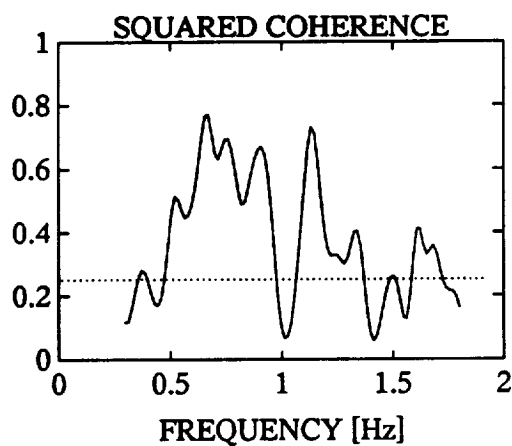
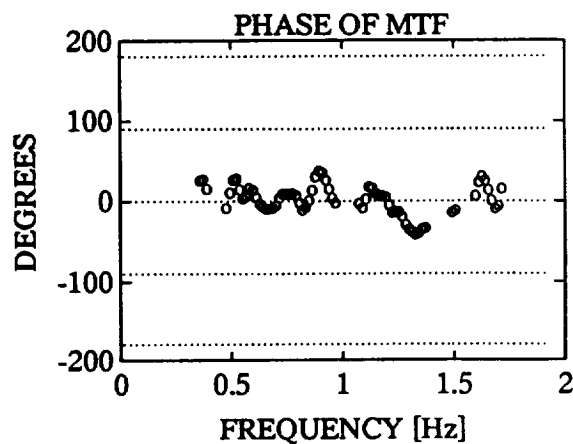
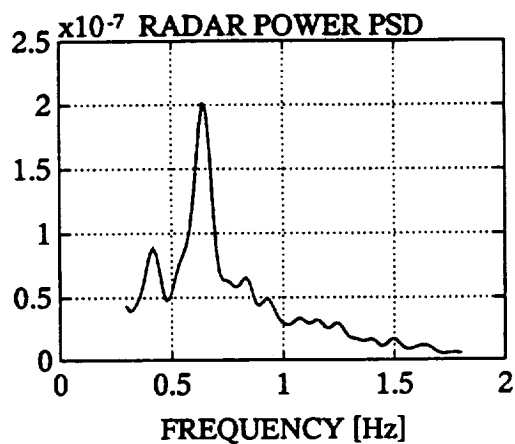
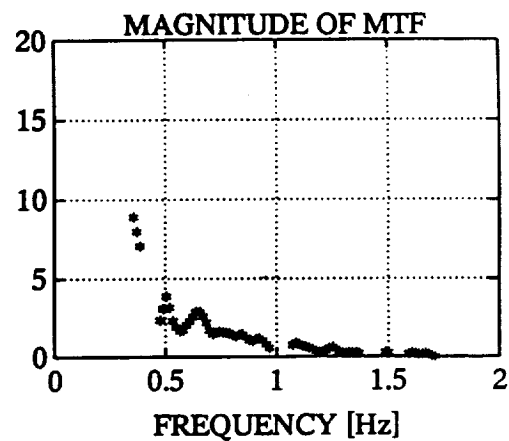
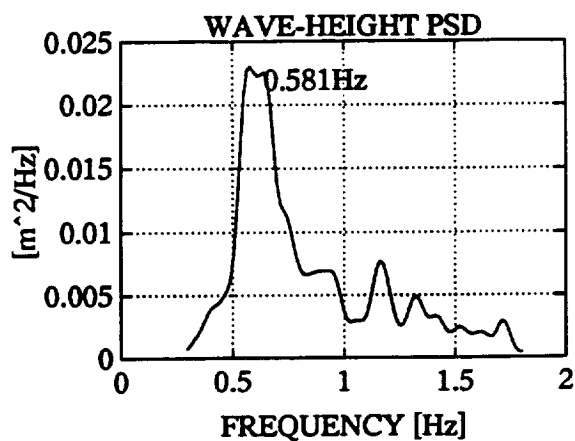
July 19, 1989, Run Time : 19:56:23, Run # 31, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 5.39 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.7 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



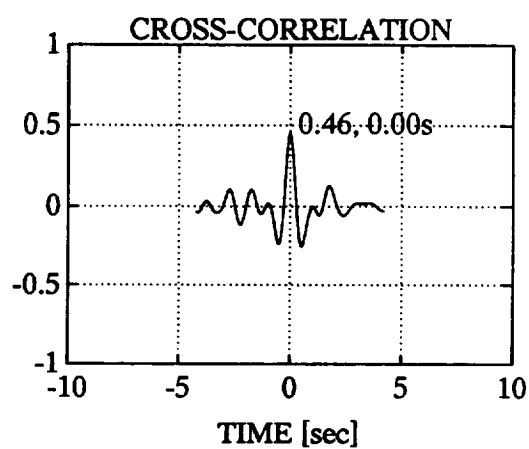
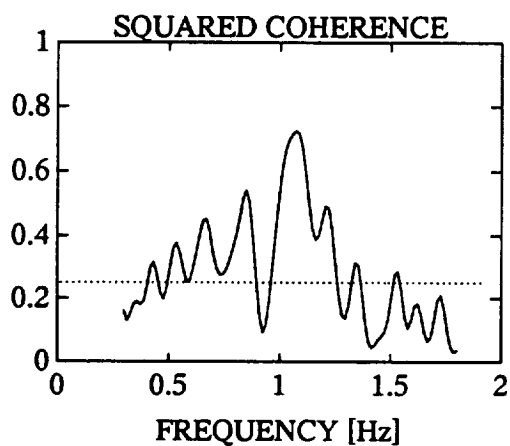
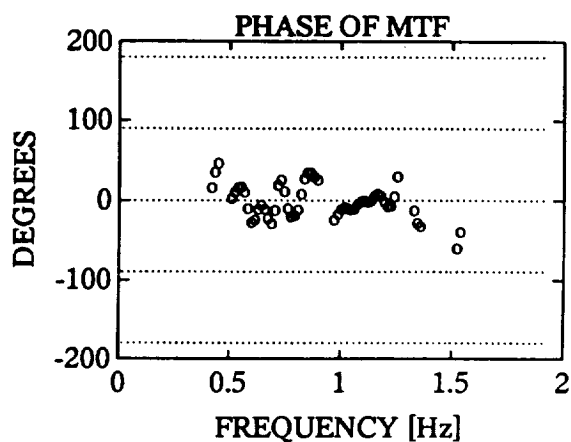
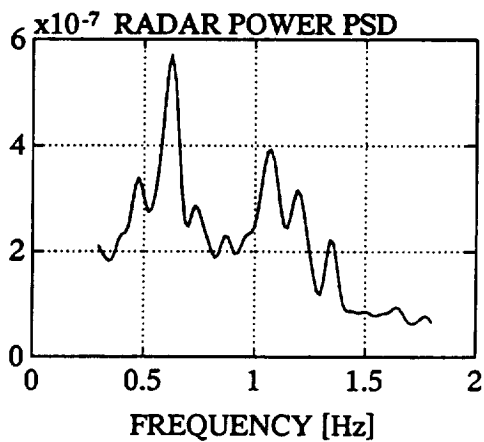
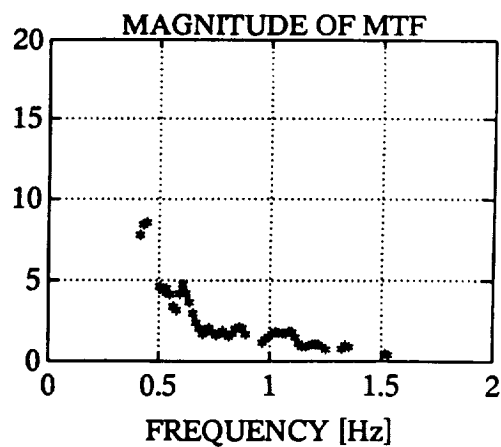
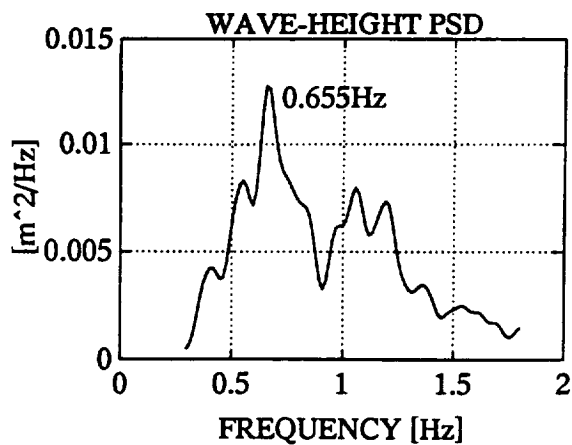
July 19, 1989, Run Time : 19:56:23, Run # 31, X Band, VV Polarization, 40.0 deg. Incidence
WindSpeed : 5.39 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.7 deg C
Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



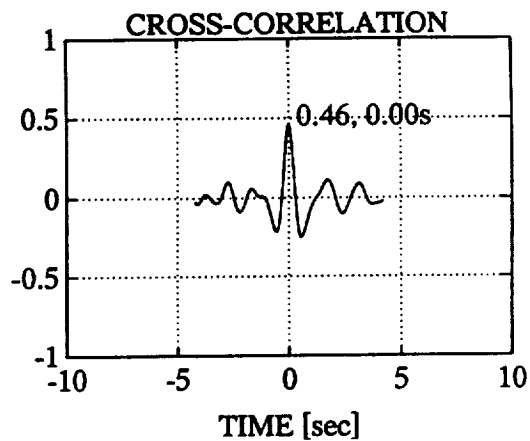
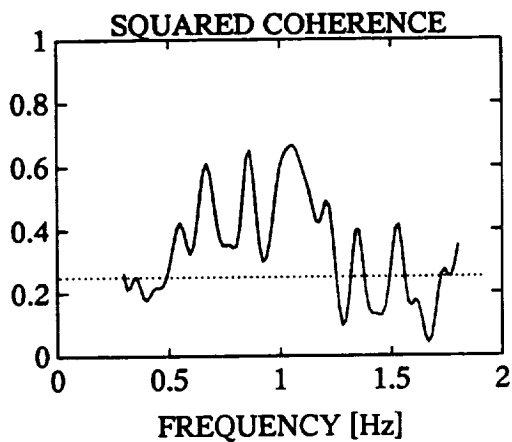
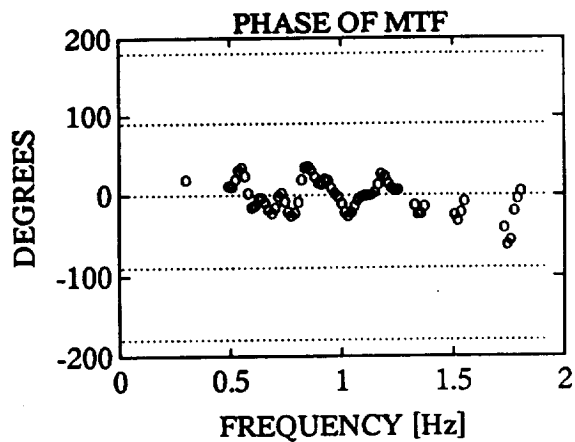
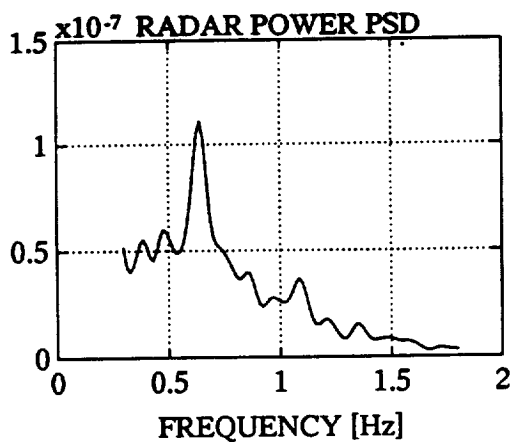
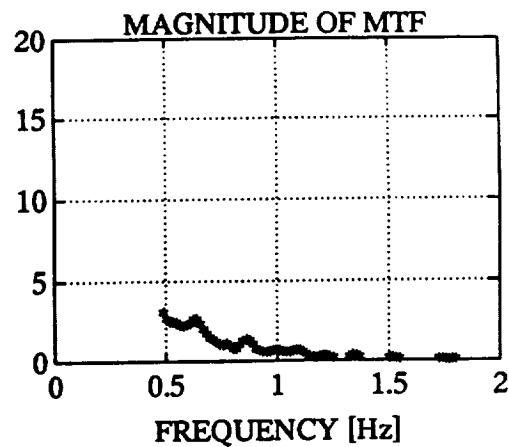
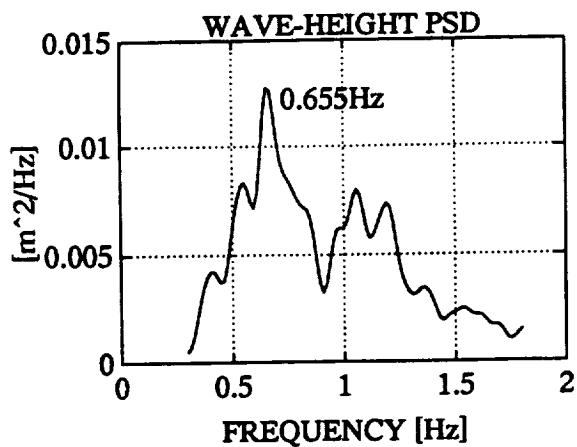
July 19, 1989, Run Time : 20: 1:40, Run # 32, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 5.24 m/s, Air Temp. : 20.8 deg C, Water Temp. : 21.7 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



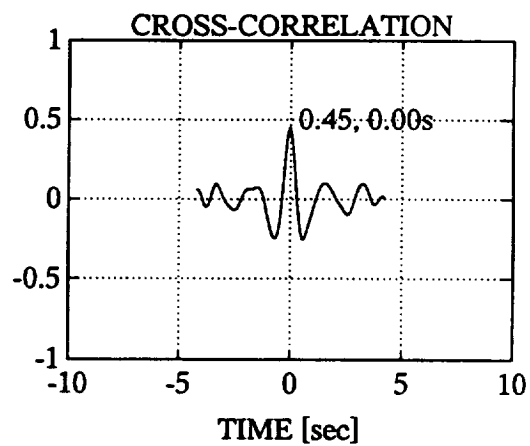
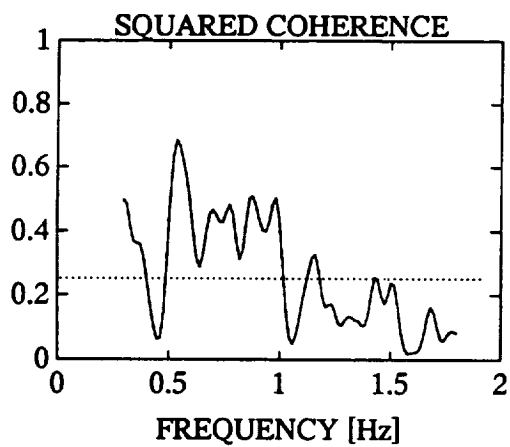
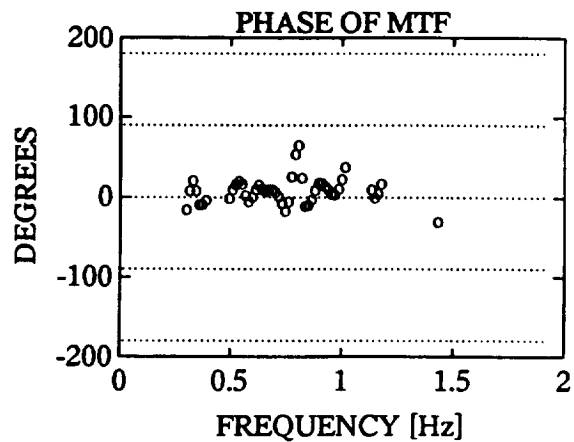
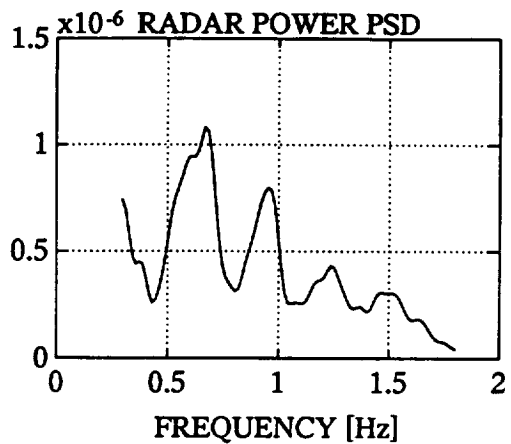
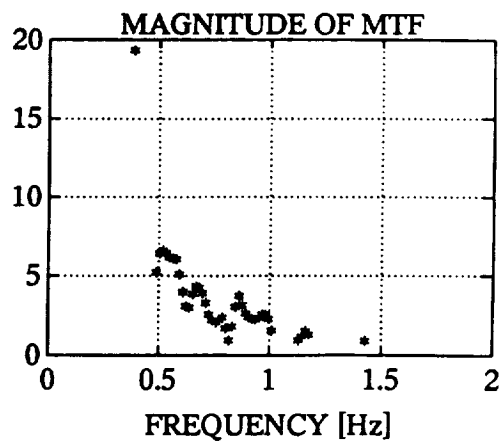
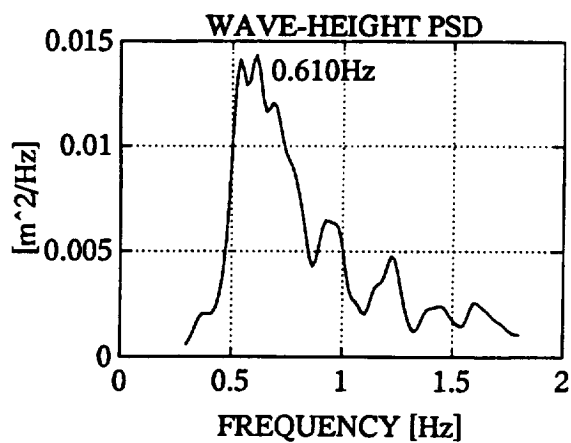
July 19, 1989, Run Time : 20: 1:40, Run # 32, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 5.24 m/s, Air Temp. : 20.8 deg C, Water Temp. : 21.7 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



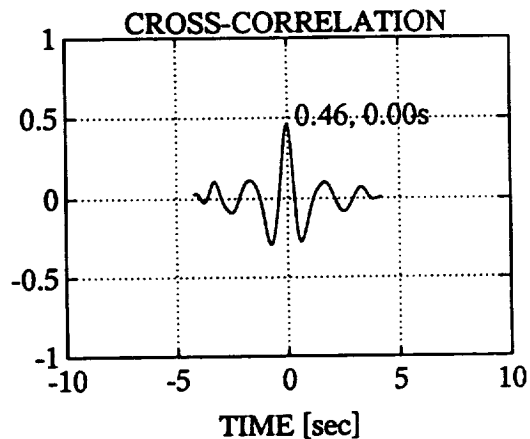
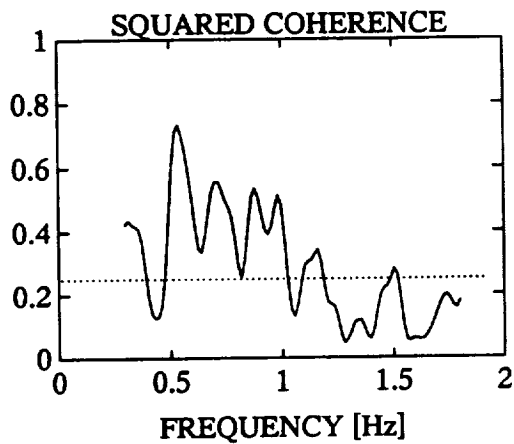
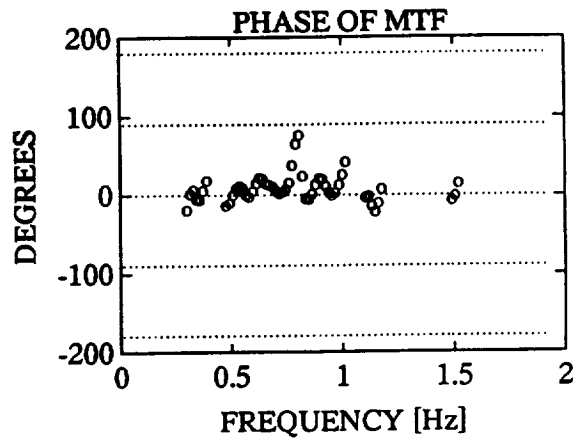
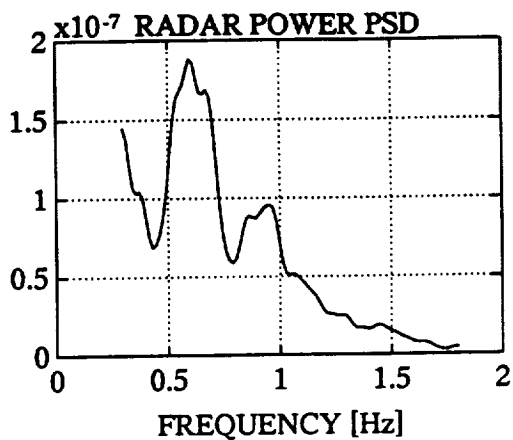
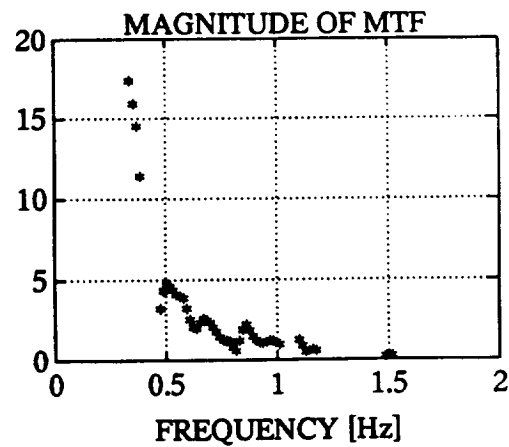
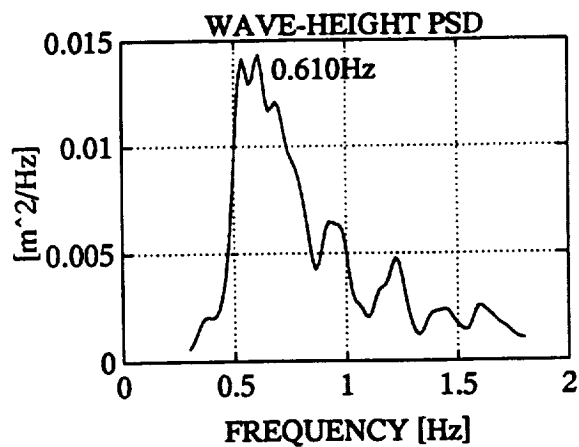
July 19, 1989, Run Time : 20: 7:34, Run # 33, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.89 m/s, Air Temp. : 20.0 deg C, Water Temp. : 21.6 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



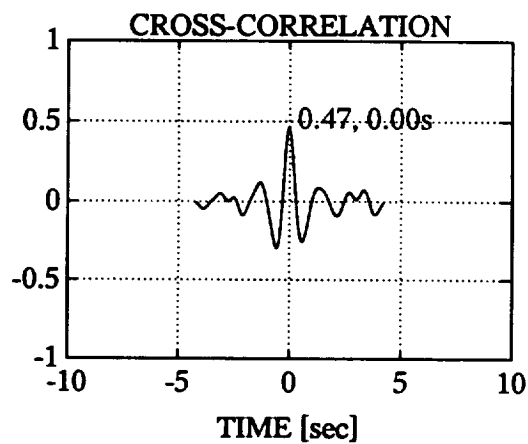
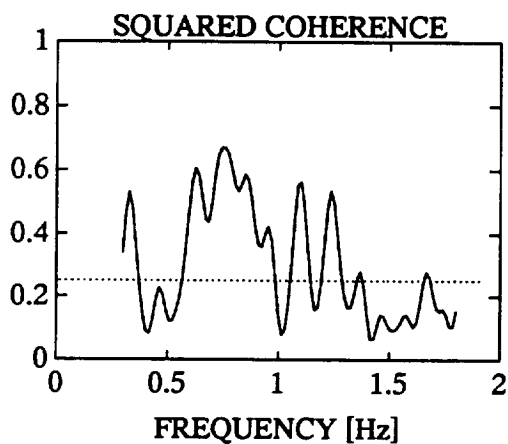
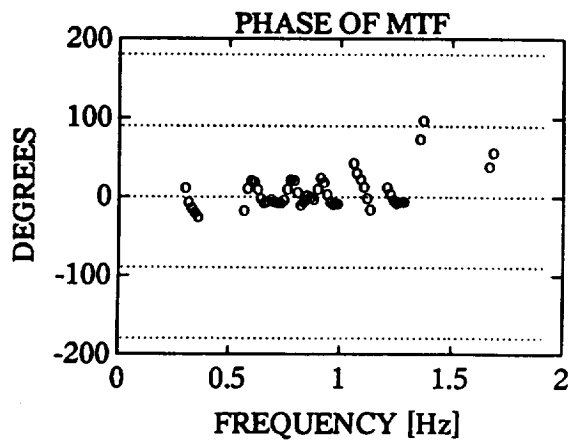
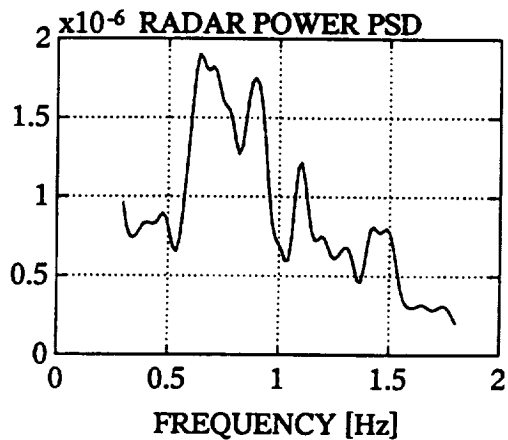
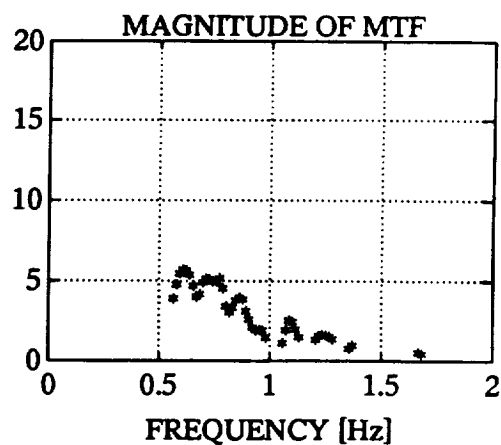
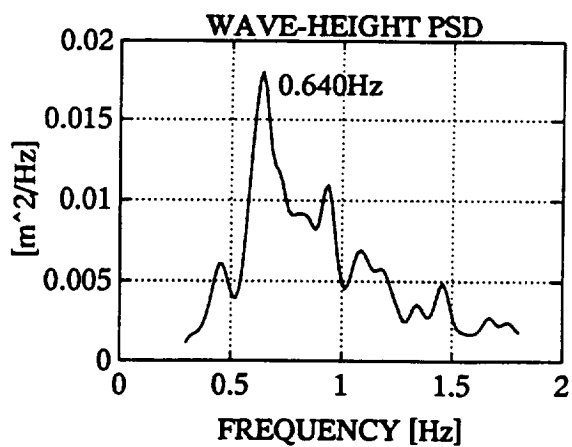
July 19, 1989, Run Time : 20: 7:34, Run # 33, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.89 m/s, Air Temp. : 20.0 deg C, Water Temp. : 21.6 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



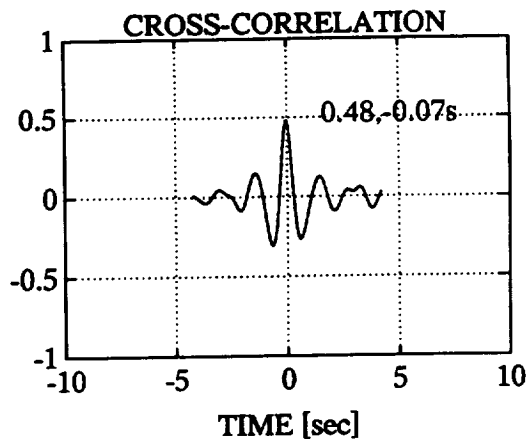
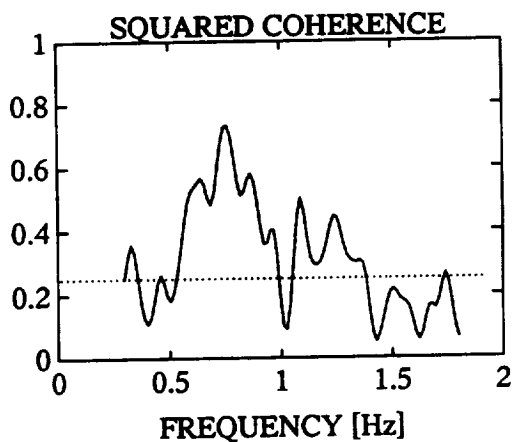
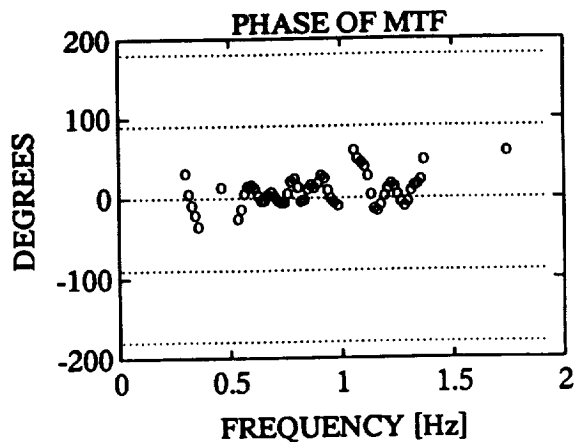
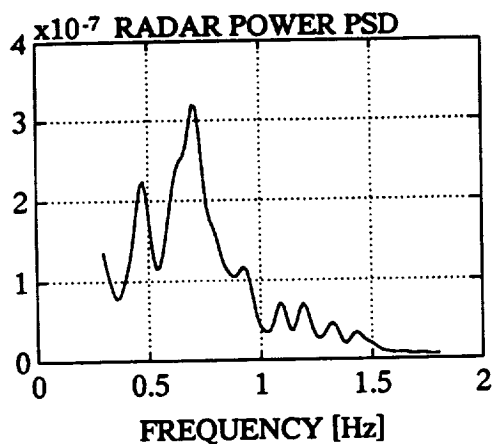
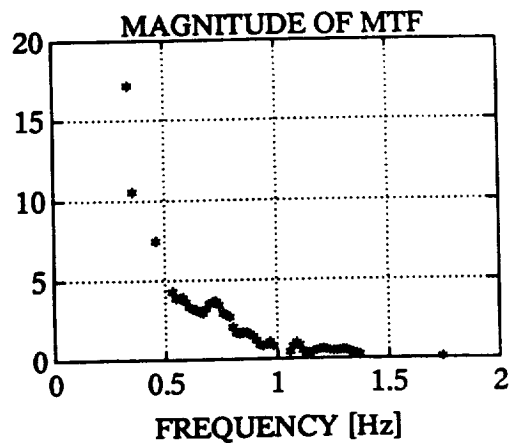
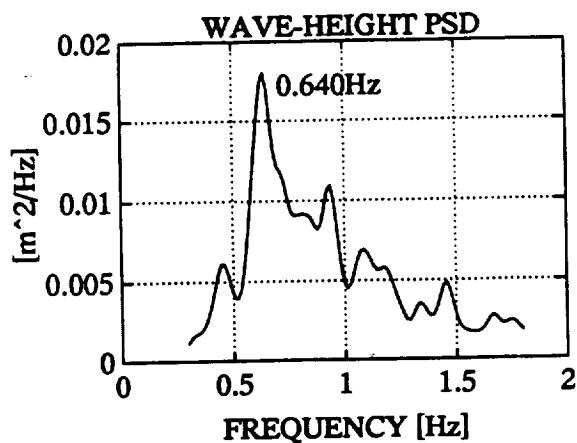
July 19, 1989, Run Time : 20:12:50, Run # 34, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.53 m/s, Air Temp. : 20.8 deg C, Water Temp. : 21.7 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



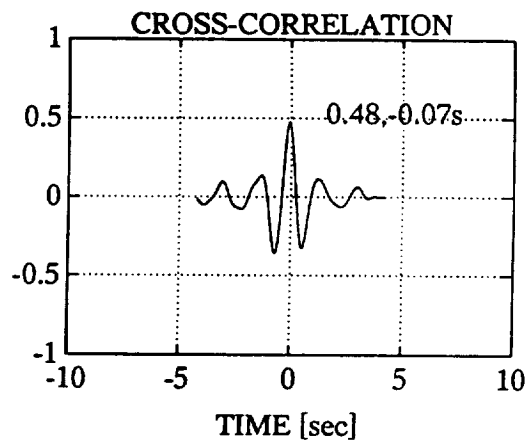
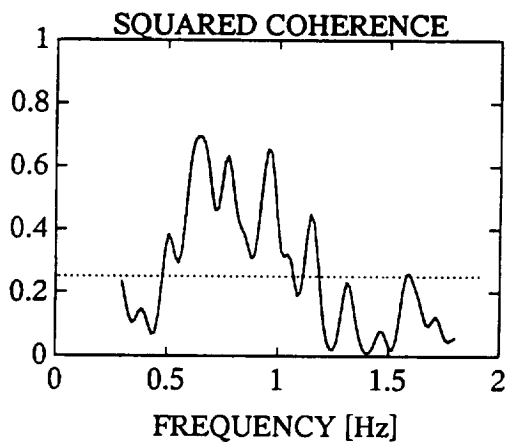
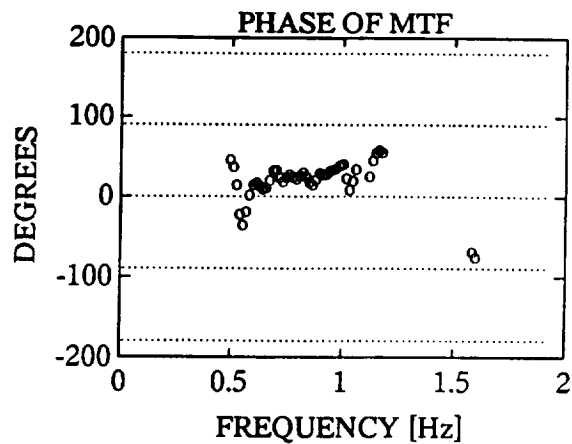
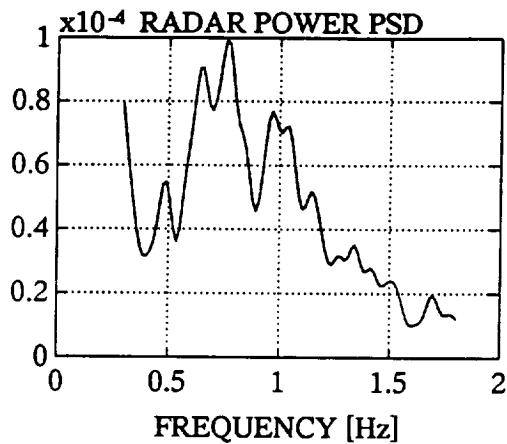
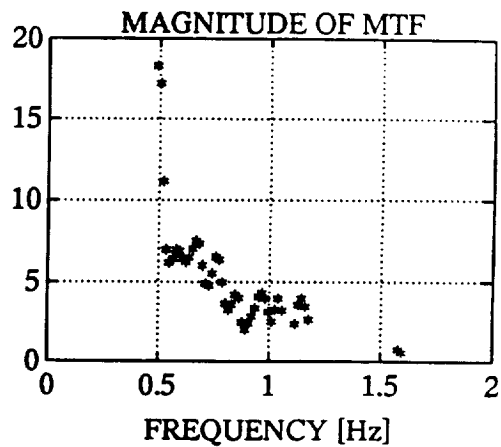
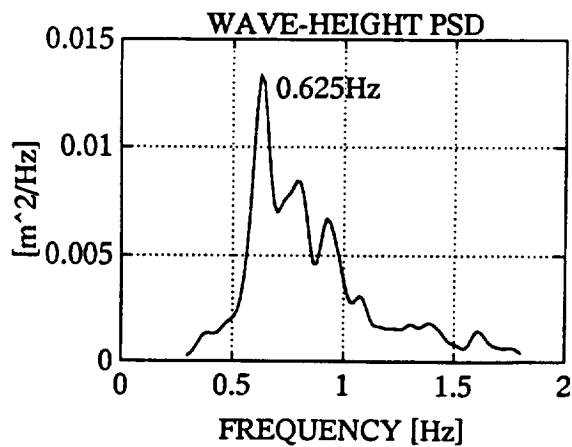
July 19, 1989, Run Time : 20:12:50, Run # 34, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.53 m/s, Air Temp. : 20.8 deg C, Water Temp. : 21.7 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



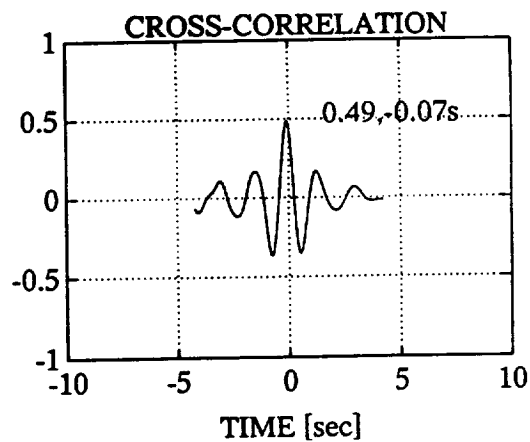
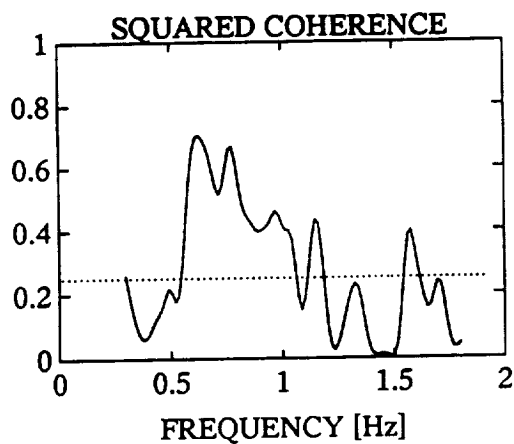
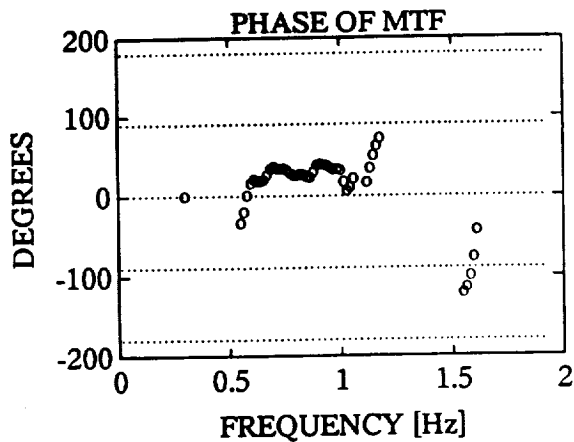
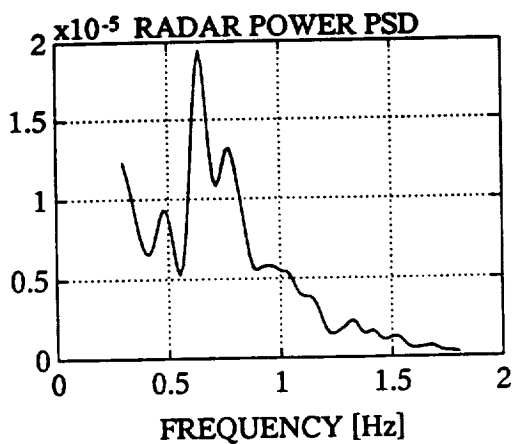
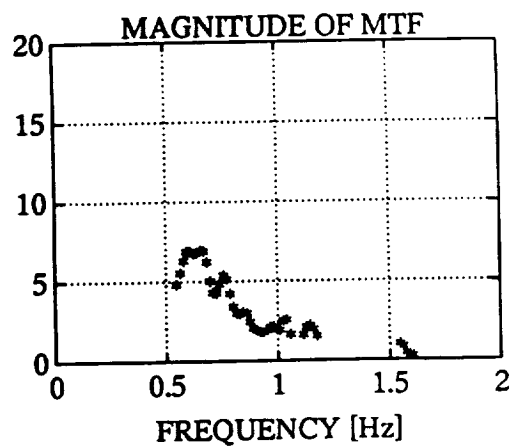
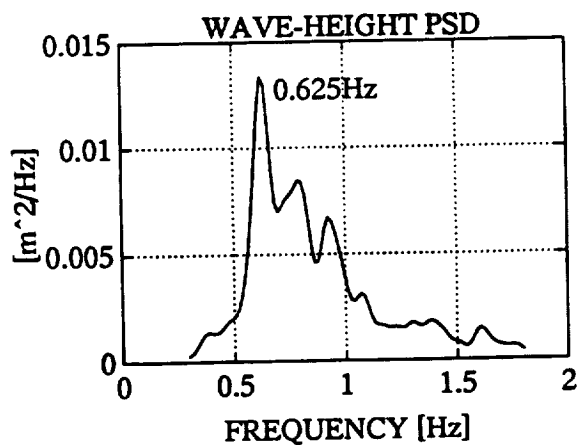
July 25, 1989, Run Time : 17:20:21, Run # 32, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.29 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : 45 deg., Spikes Present



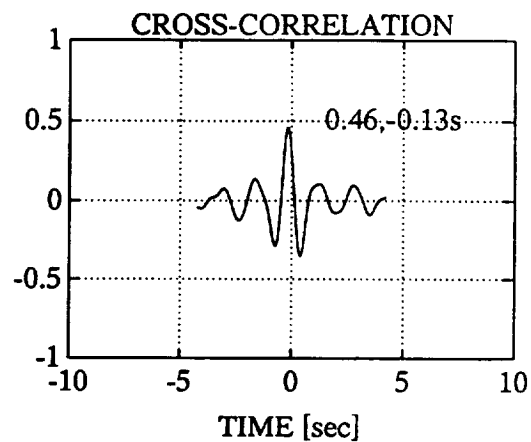
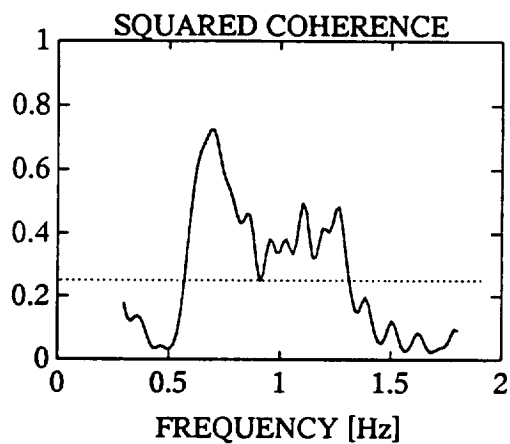
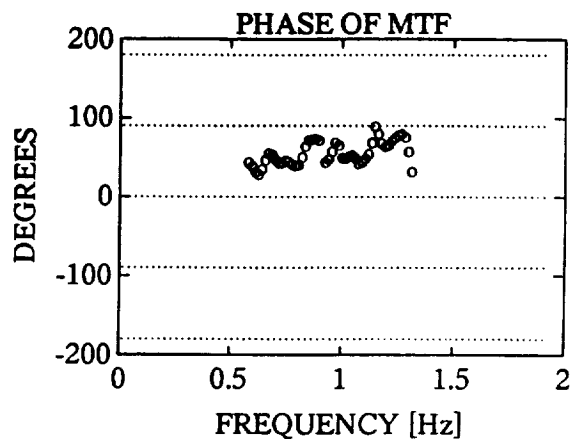
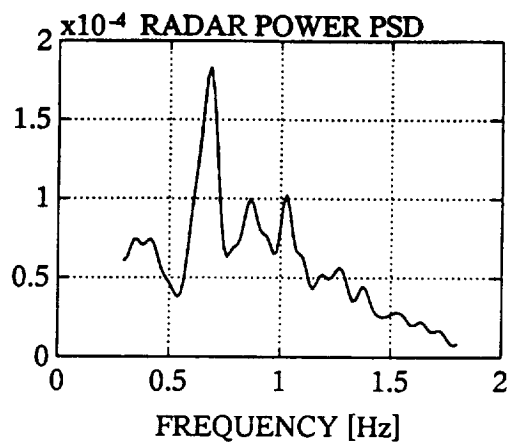
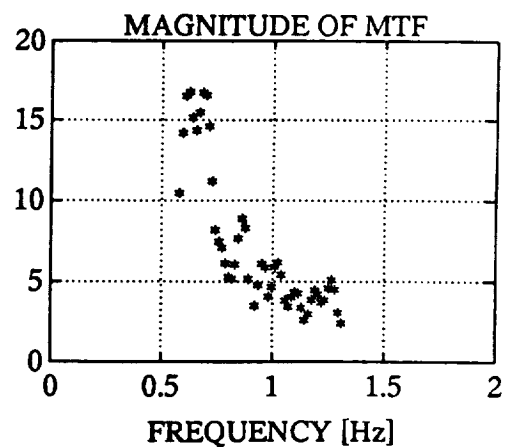
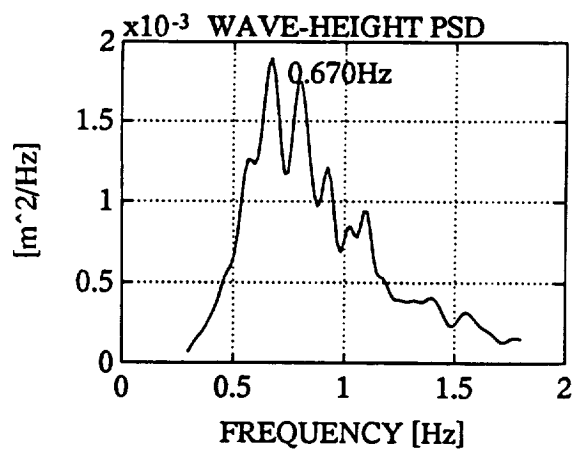
July 25, 1989, Run Time : 17:20:21, Run # 32, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.29 m/s, Air Temp. : 20.9 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : 45 deg., Spikes Removed (4.5 dB Moving Agerage Threshold)



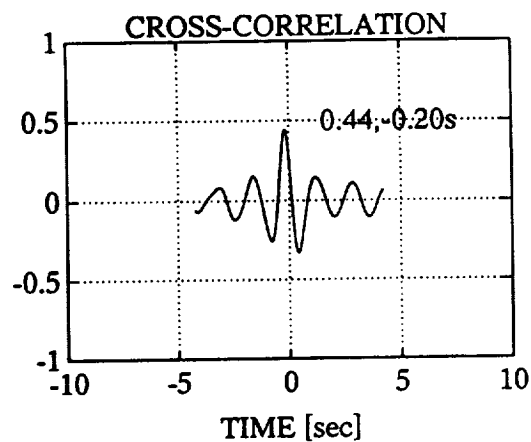
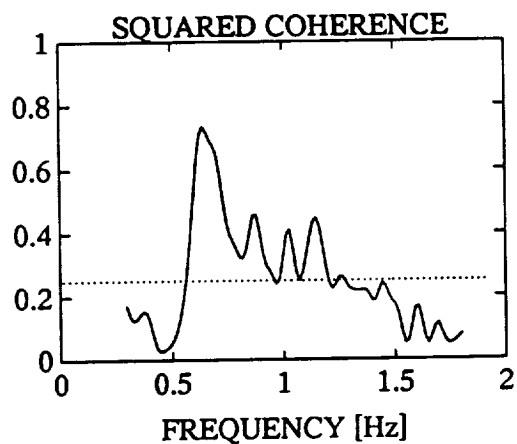
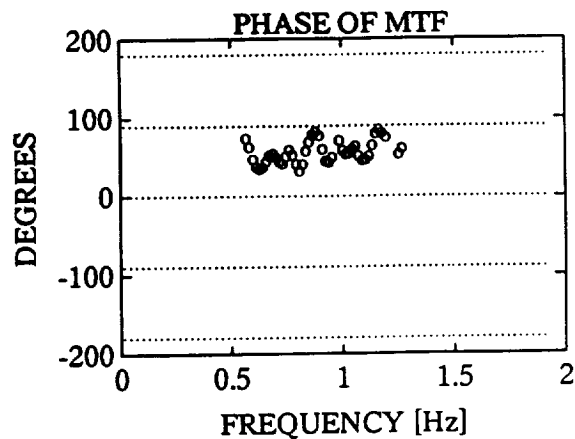
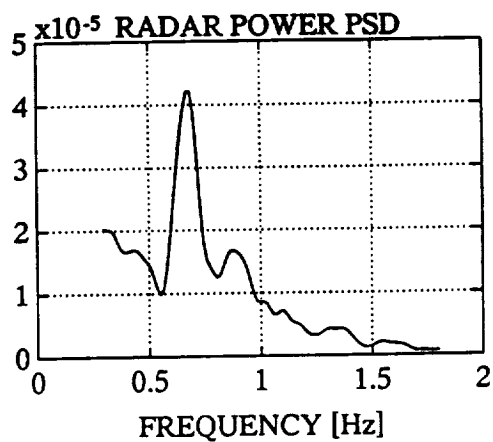
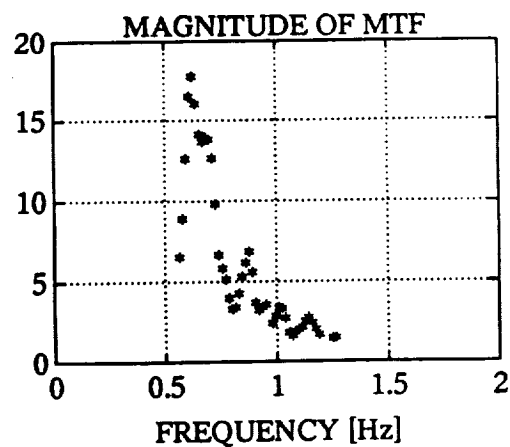
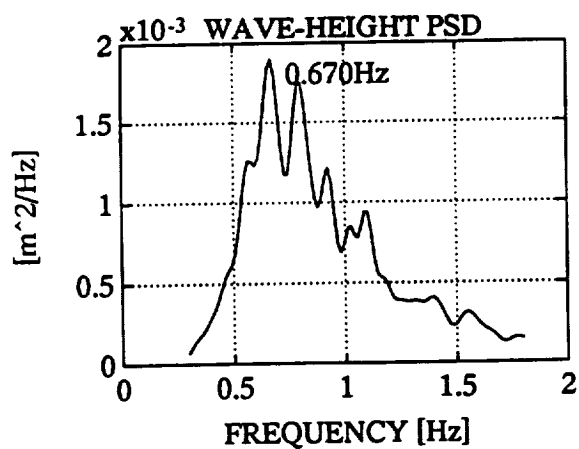
Aug. 3, 1989, Run Time : 18:14:50, Run # 7, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.32 m/s, Air Temp. : 20.4 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



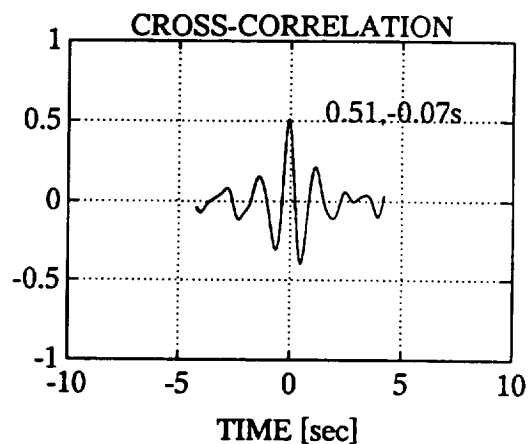
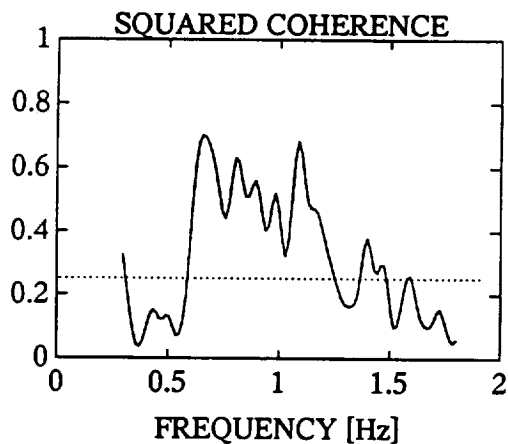
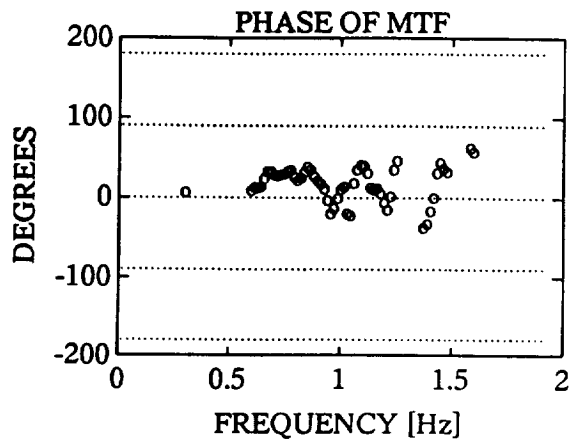
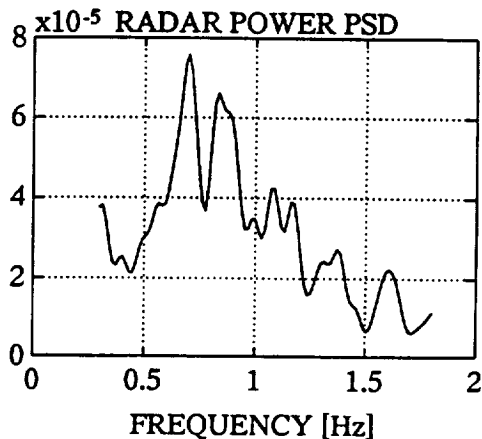
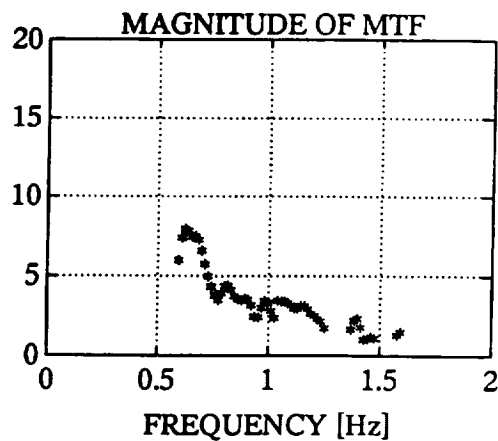
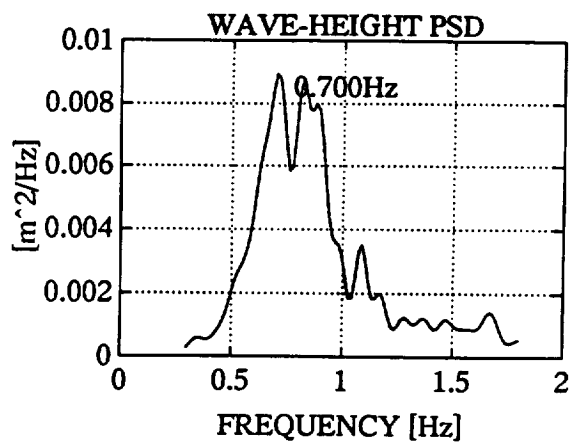
Aug. 3, 1989, Run Time : 18:14:50, Run # 7, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.32 m/s, Air Temp. : 20.4 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



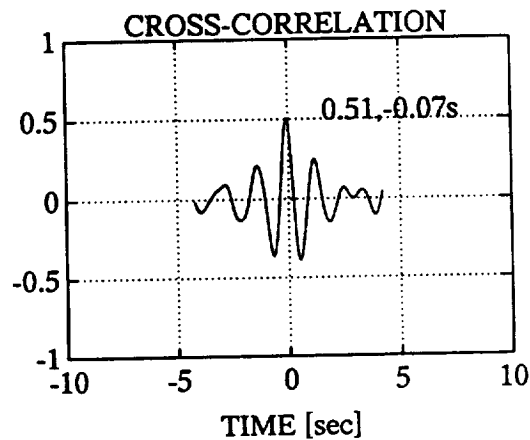
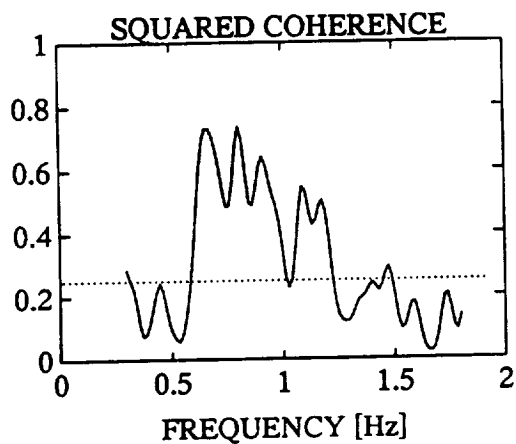
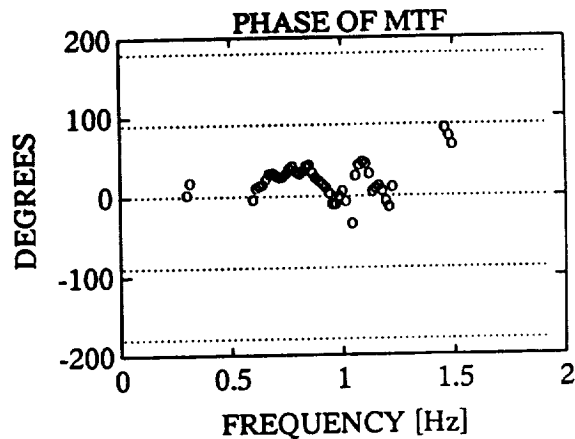
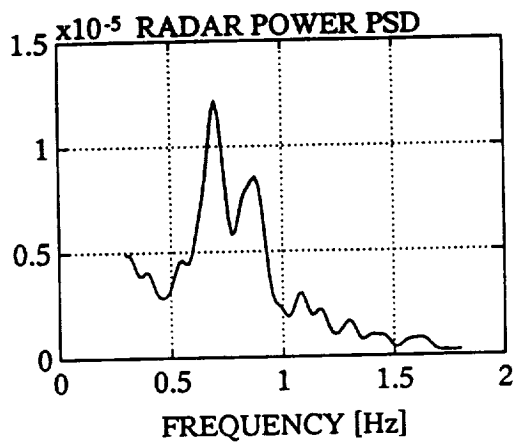
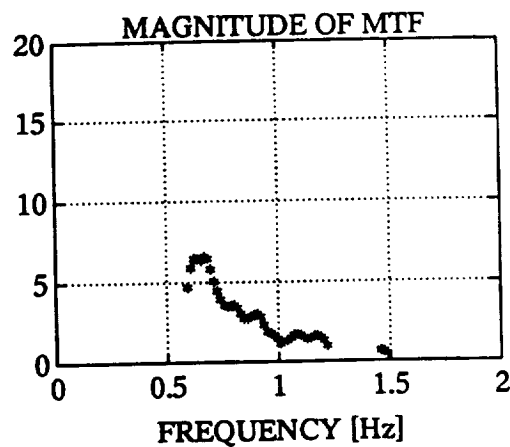
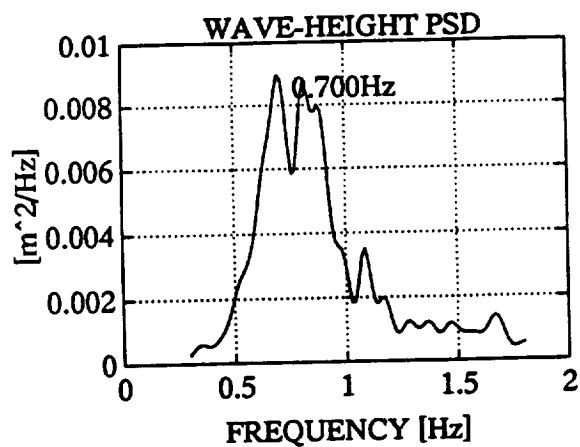
Aug. 3, 1989, Run Time : 18:24:43, Run # 8, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 20.3 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



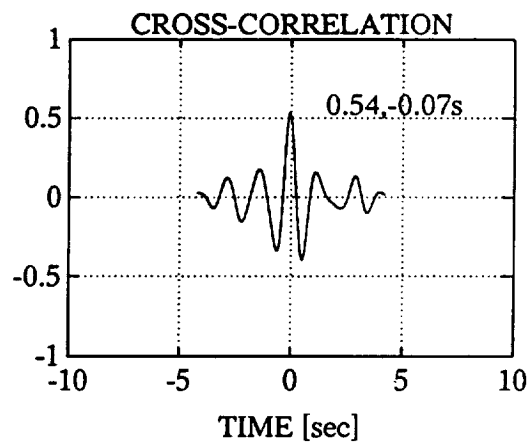
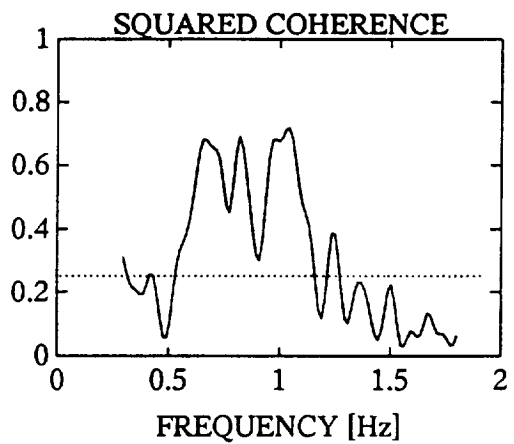
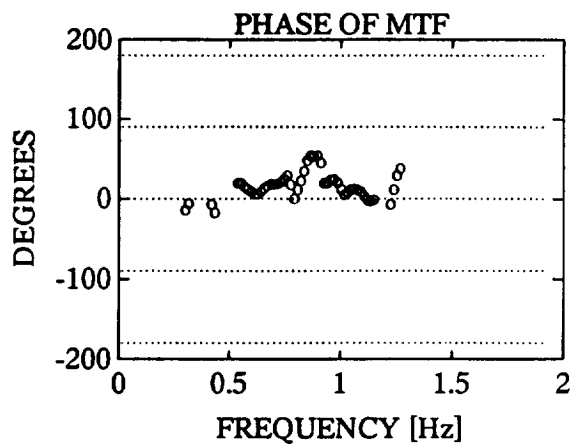
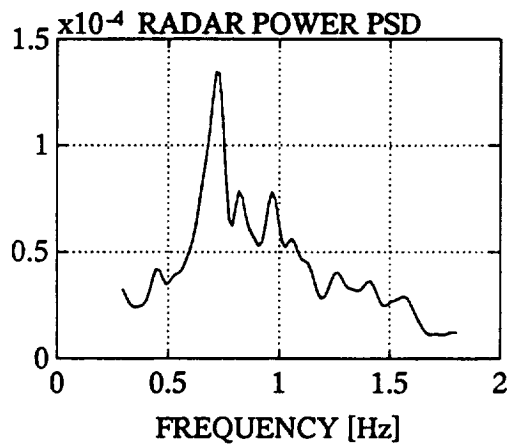
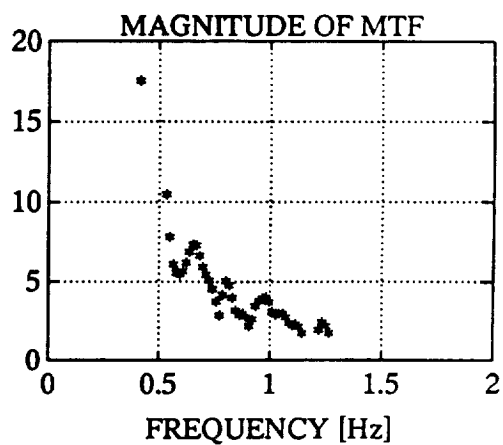
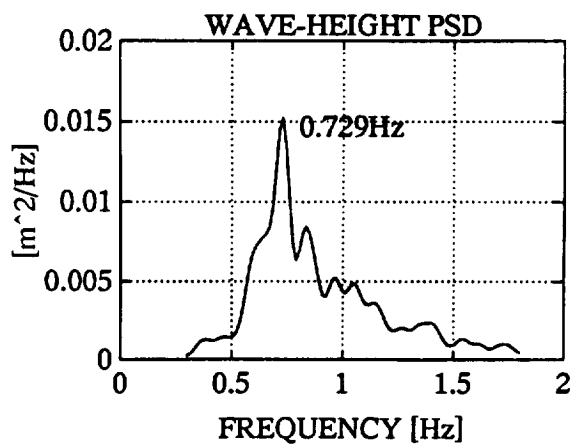
Aug. 3, 1989, Run Time : 18:24:43, Run # 8, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 20.3 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



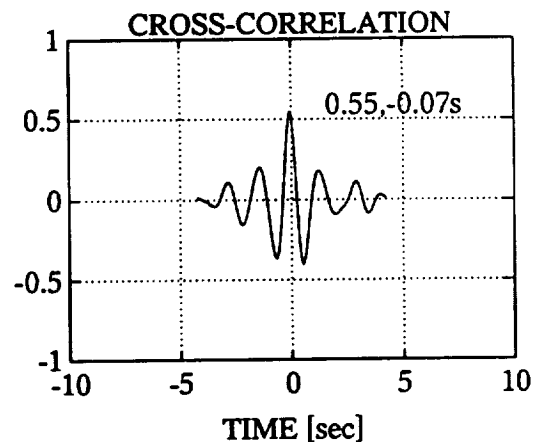
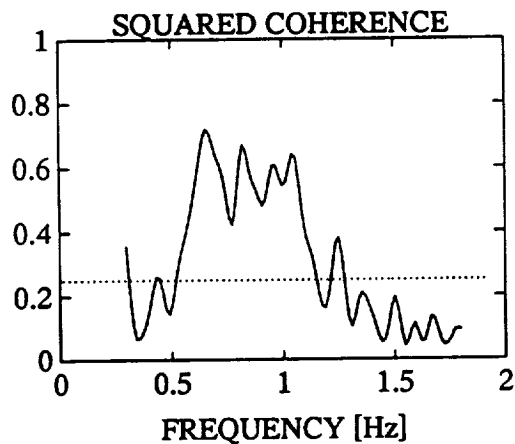
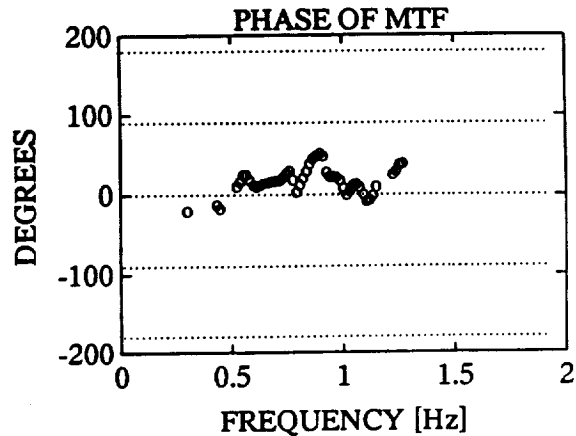
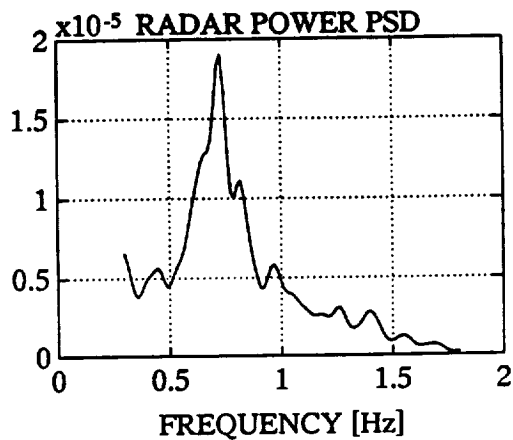
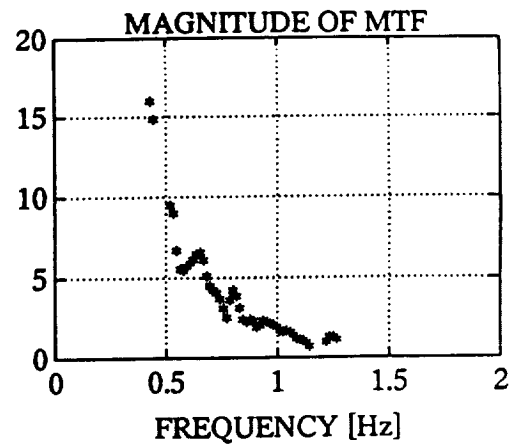
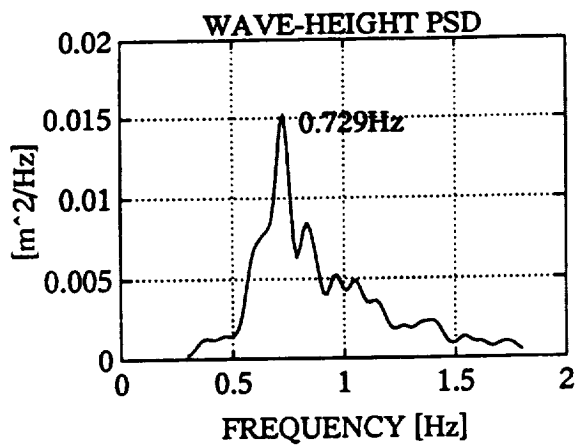
Aug. 3, 1989, Run Time : 18:31:20, Run # 9, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.40 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



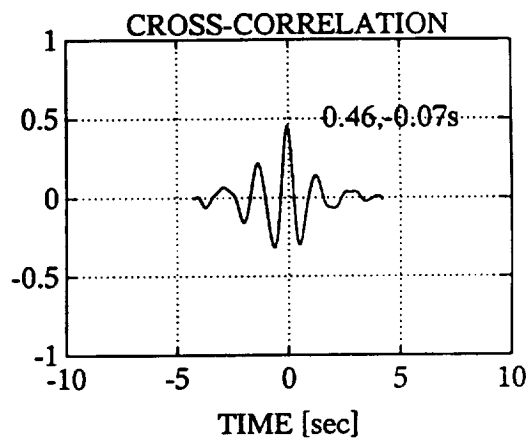
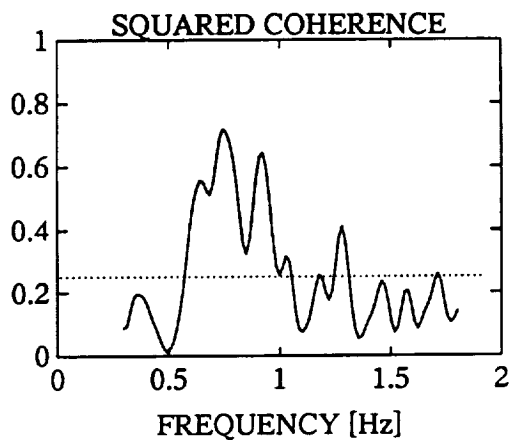
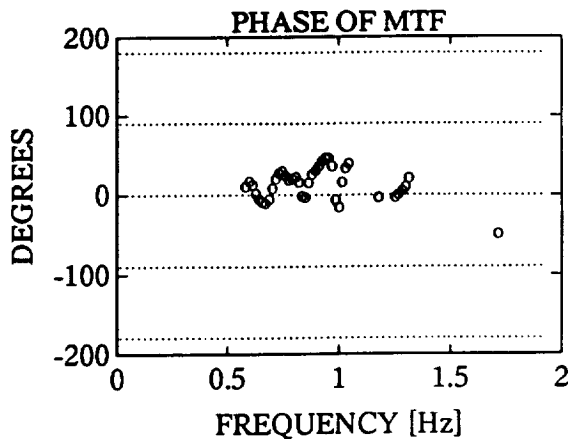
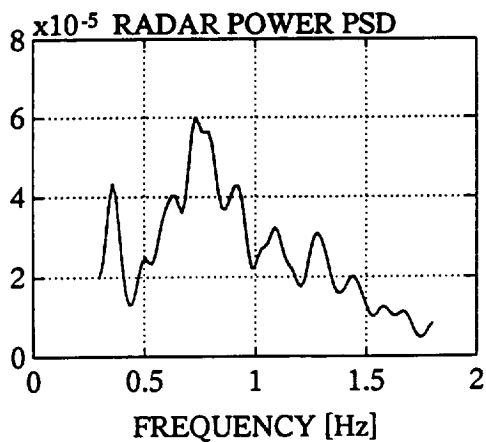
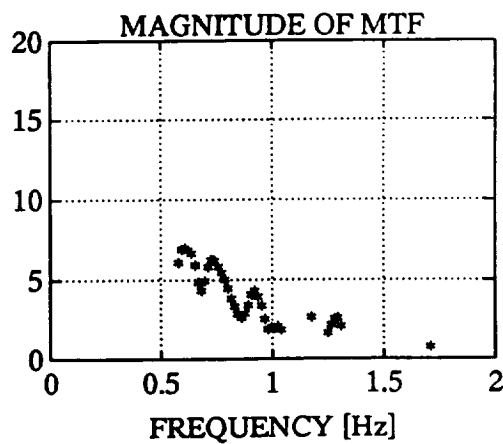
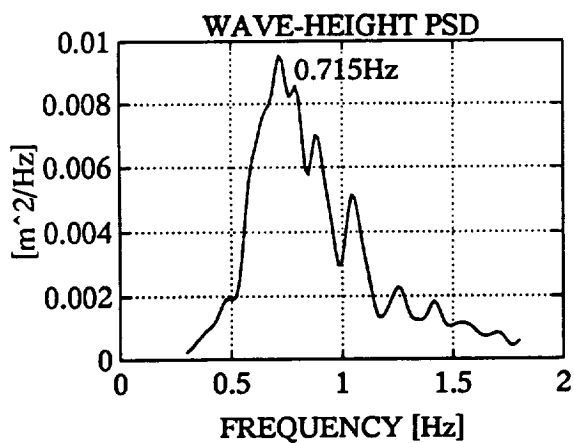
Aug. 3, 1989, Run Time : 18:31:20, Run # 9, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.40 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



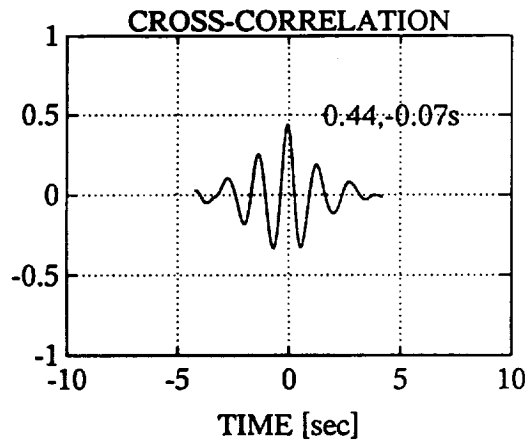
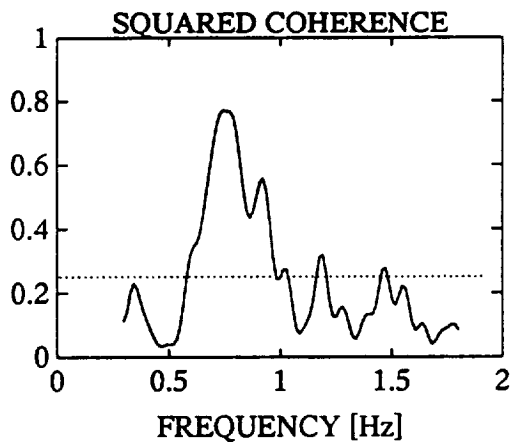
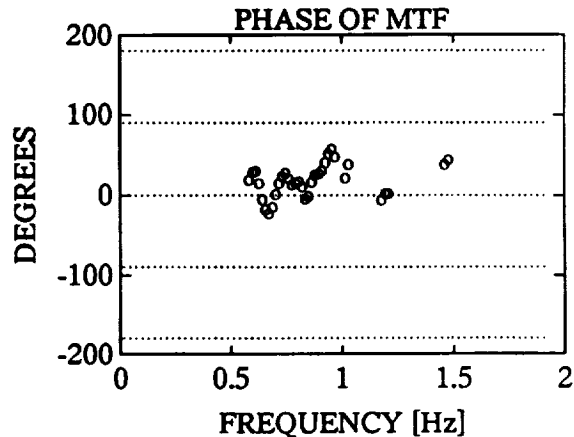
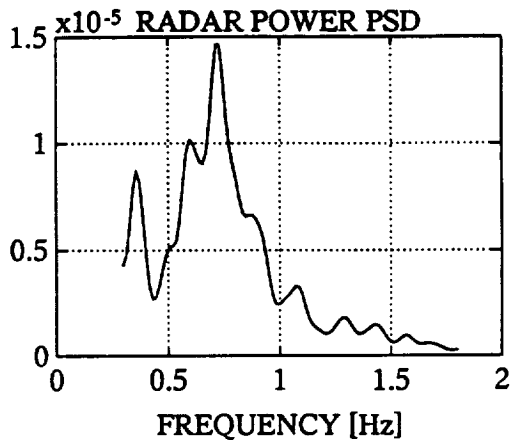
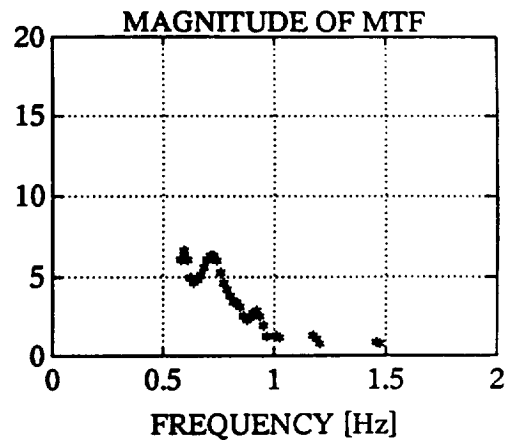
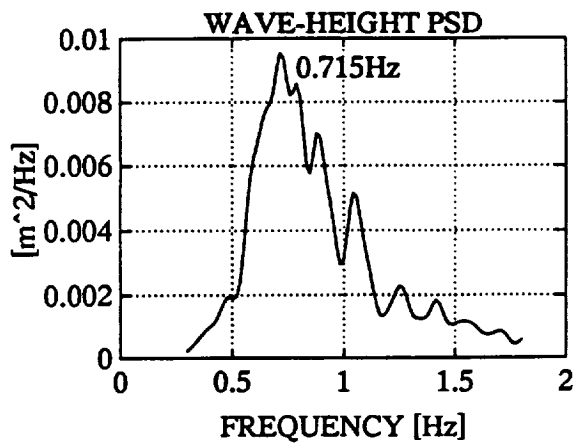
Aug. 3, 1989, Run Time : 18:38:36, Run # 10, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.91 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



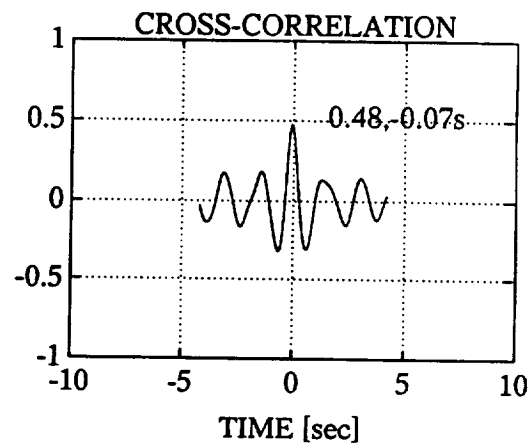
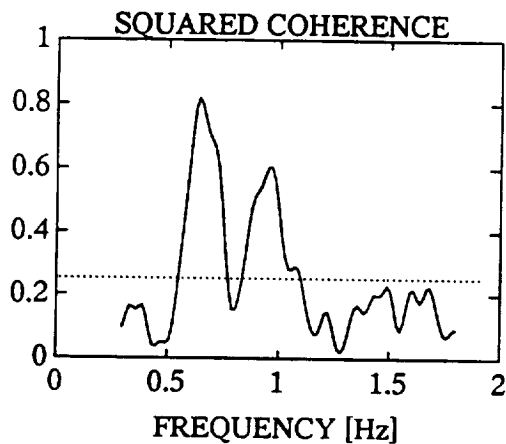
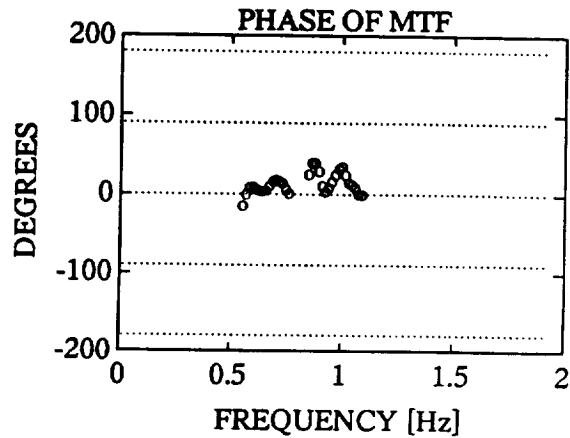
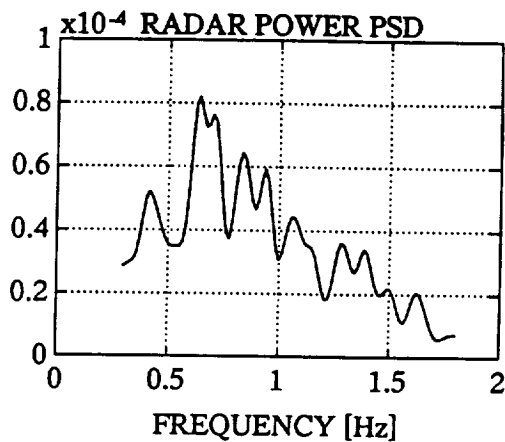
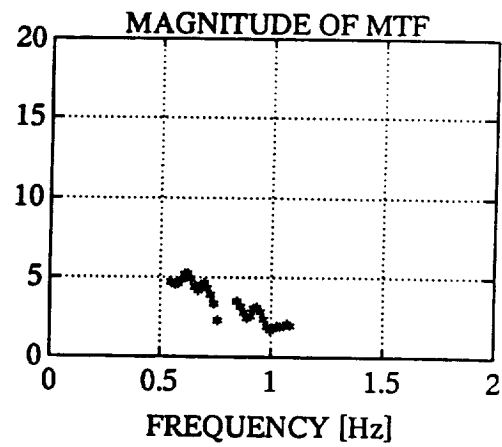
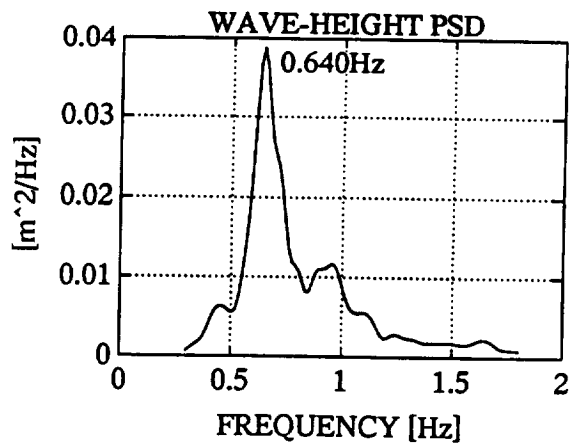
Aug. 3, 1989, Run Time : 18:38:36, Run # 10, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.91 m/s, Air Temp. : 20.2 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



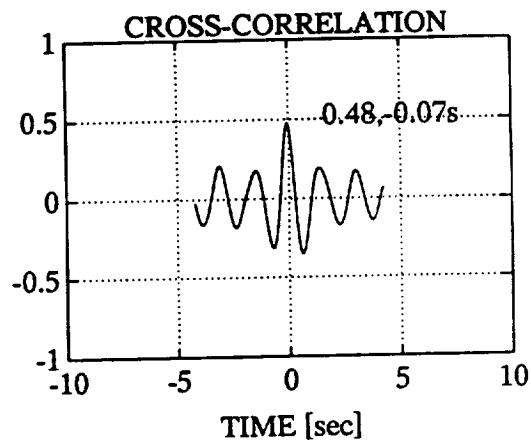
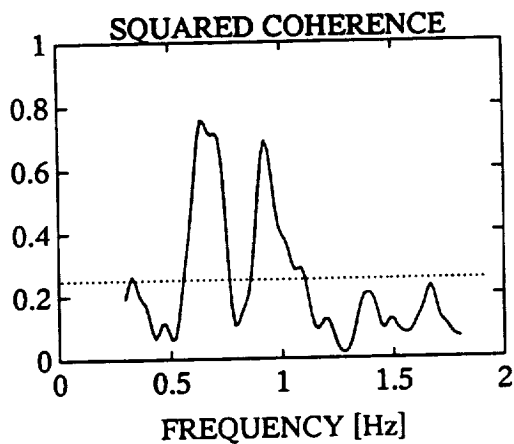
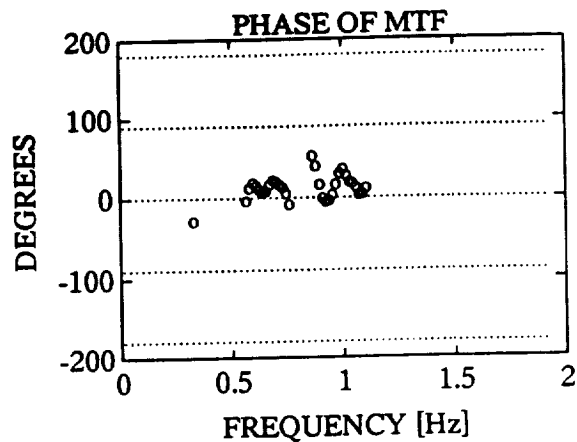
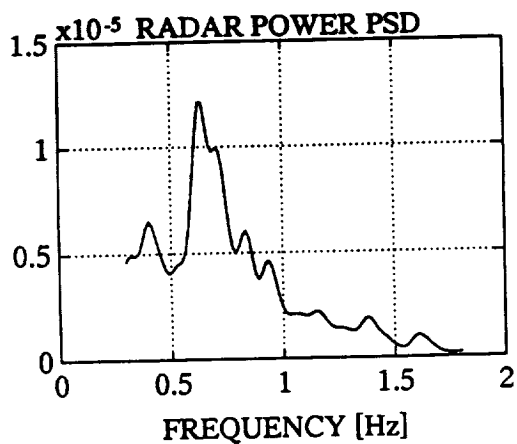
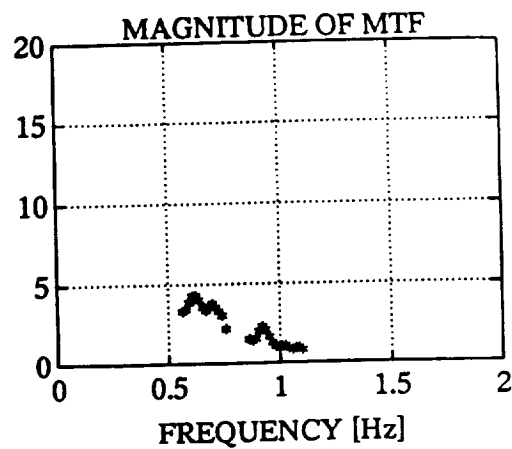
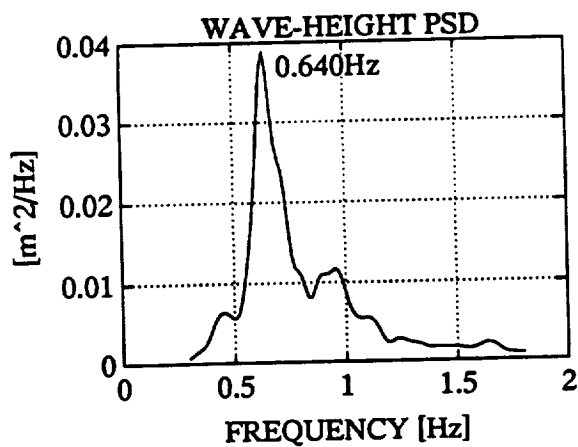
Aug. 3, 1989, Run Time : 18:44: 4, Run # 11, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.03 m/s, Air Temp. : 20.1 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



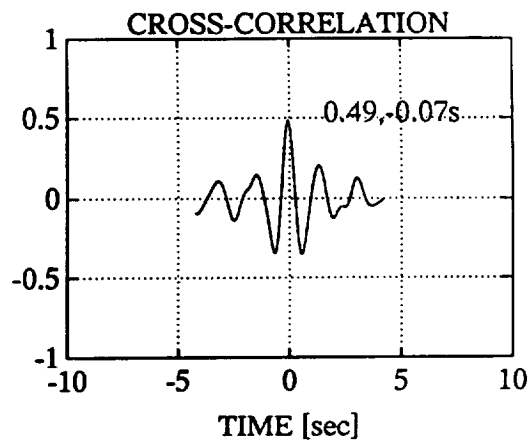
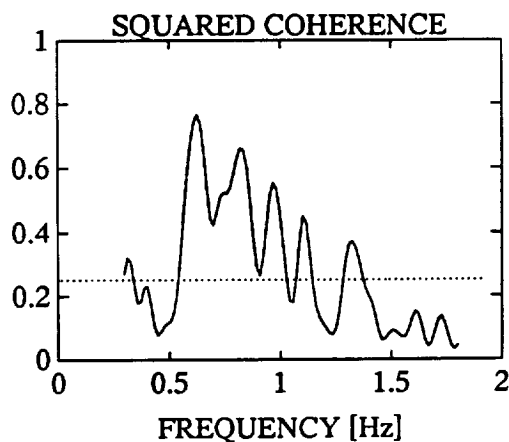
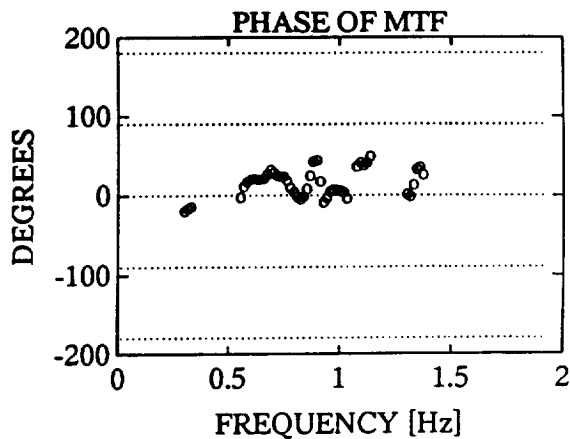
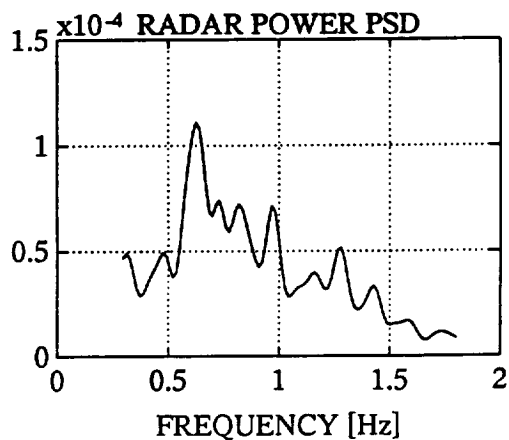
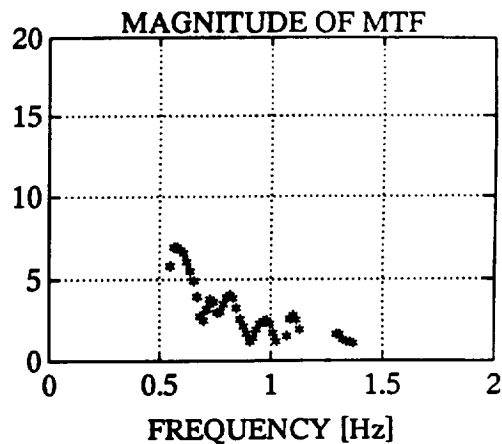
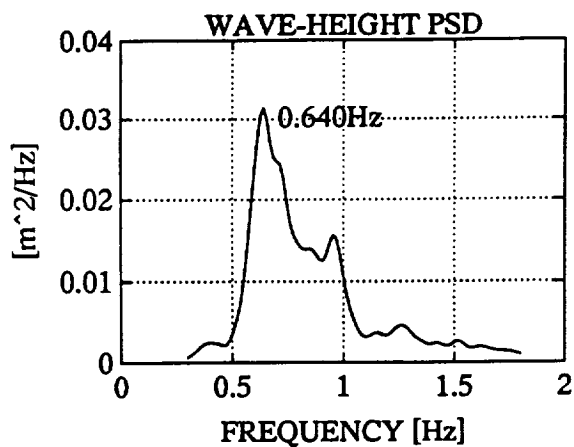
Aug. 3, 1989, Run Time : 18:44: 4, Run # 11, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.03 m/s, Air Temp. : 20.1 deg C, Water Temp. : 20.9 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



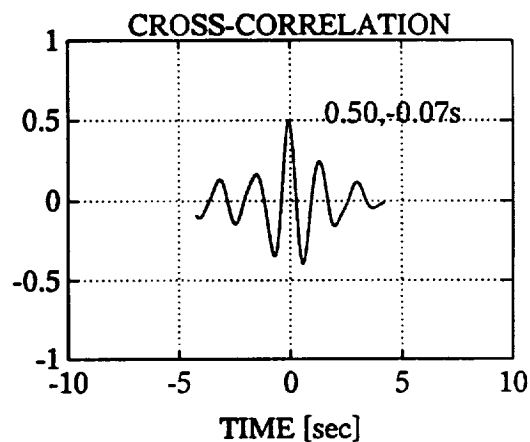
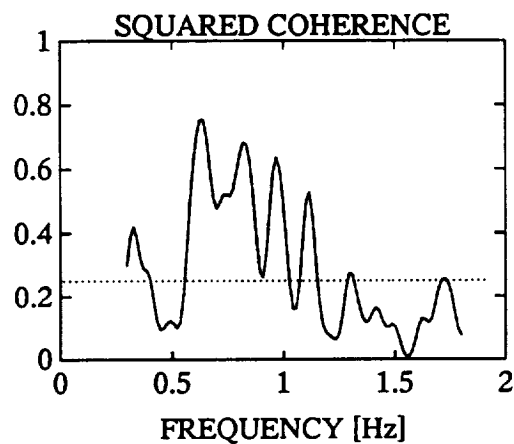
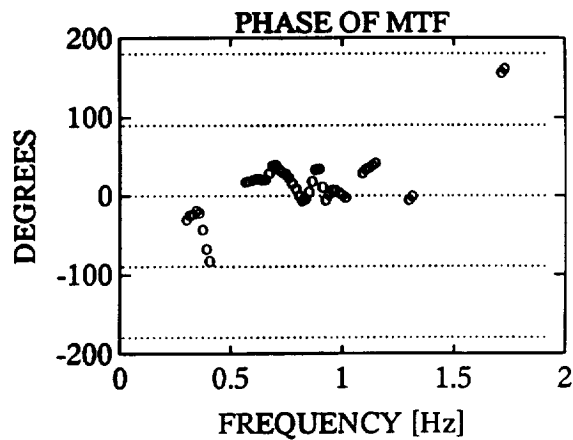
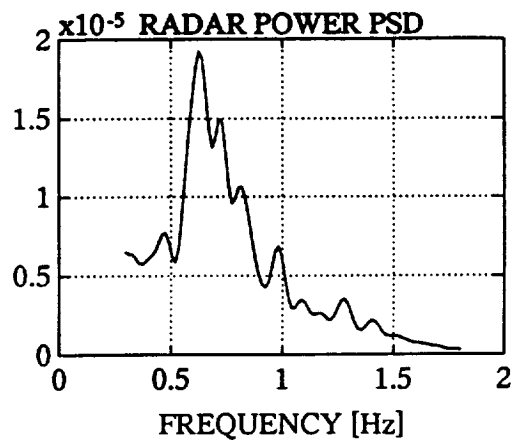
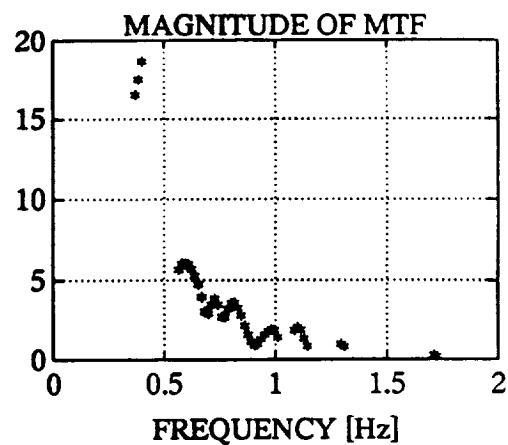
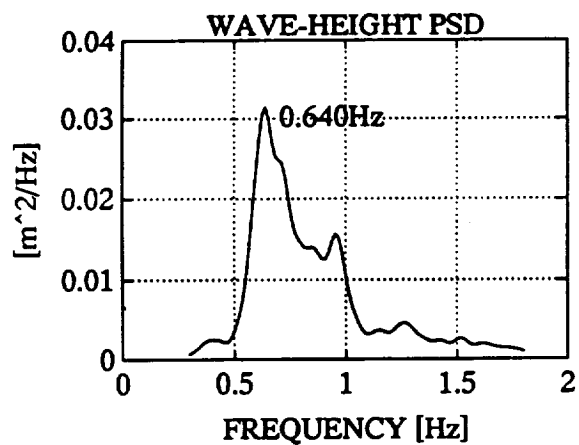
Aug. 3, 1989, Run Time : 19:13:51, Run # 12, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.17 m/s, Air Temp. : 19.7 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



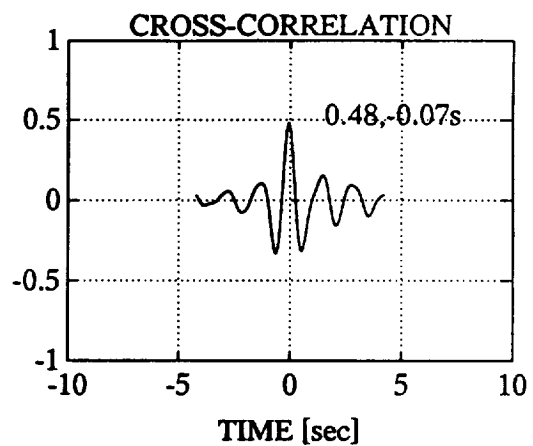
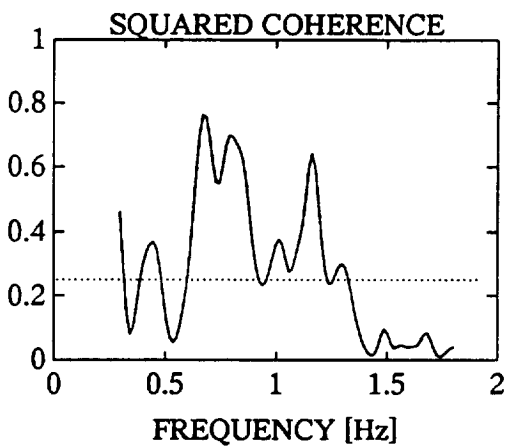
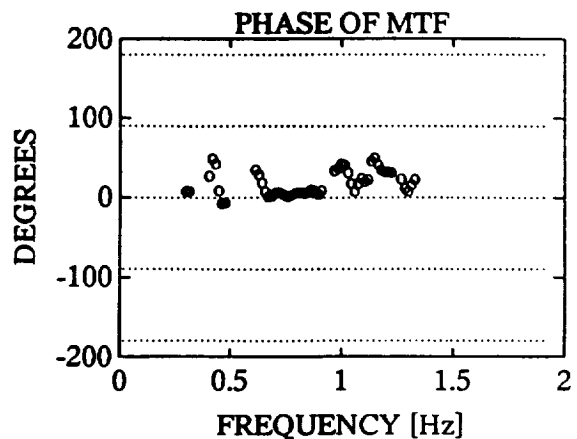
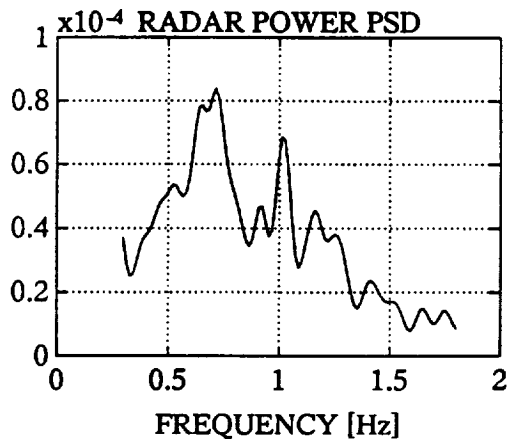
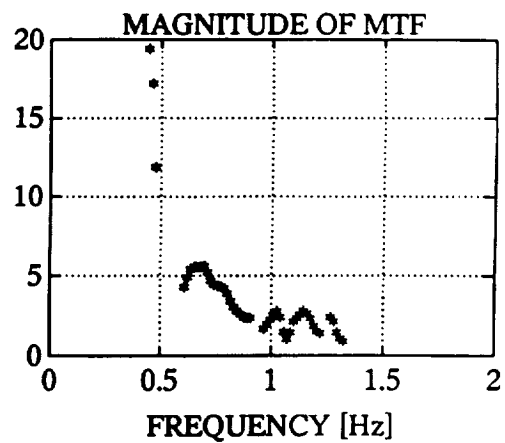
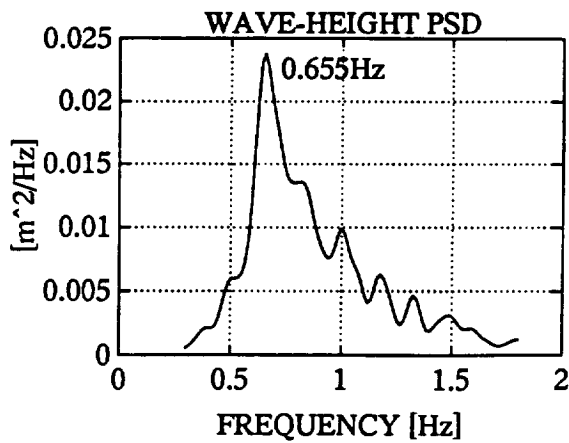
Aug. 3, 1989, Run Time : 19:13:51, Run # 12, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.17 m/s, Air Temp. : 19.7 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



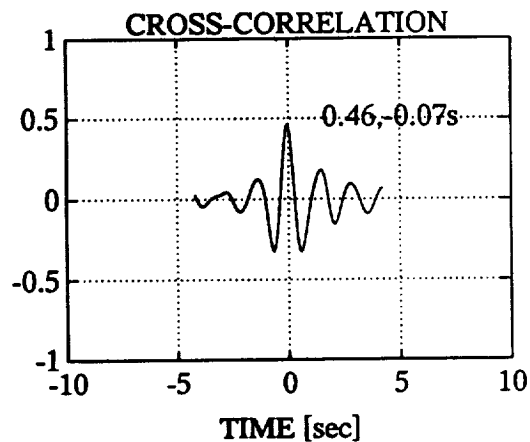
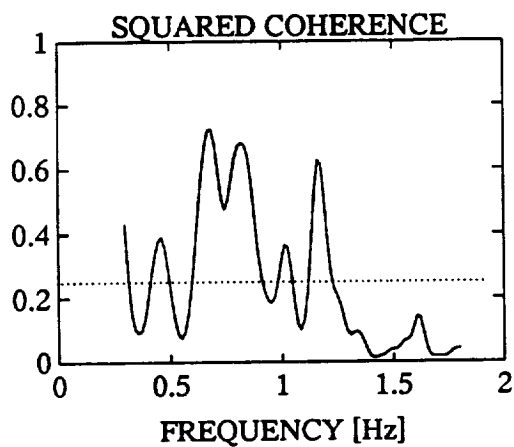
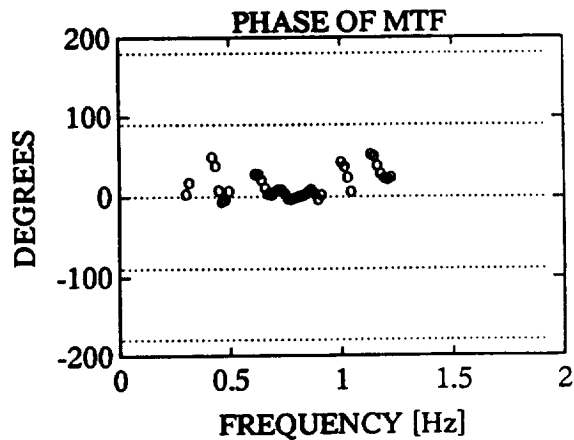
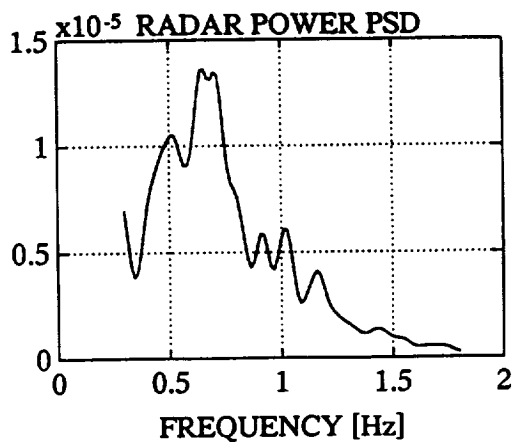
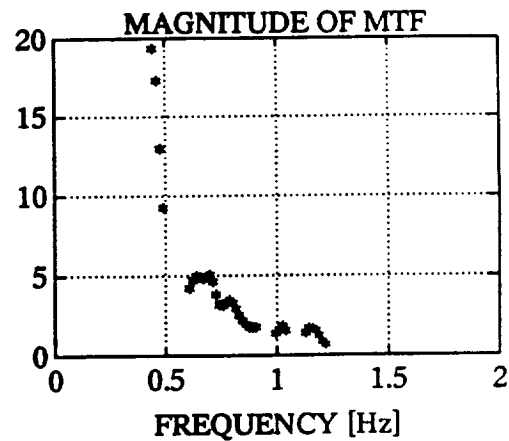
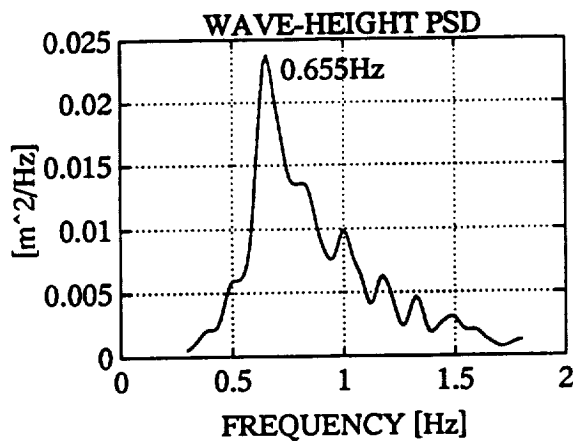
Aug. 3, 1989, Run Time : 19:19:56, Run # 13, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 19.6 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



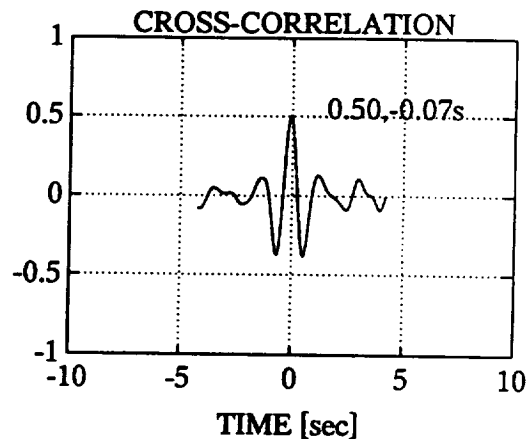
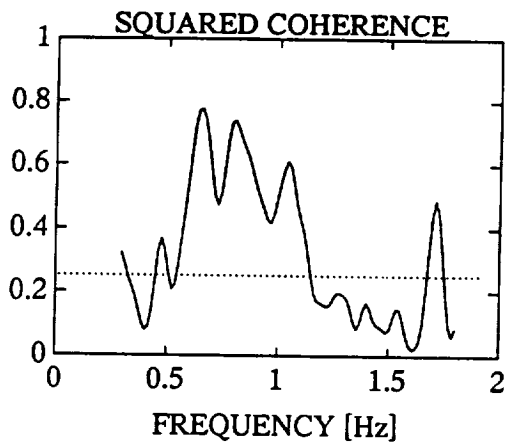
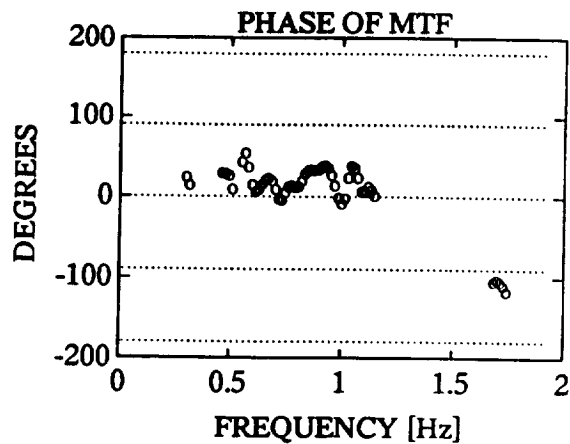
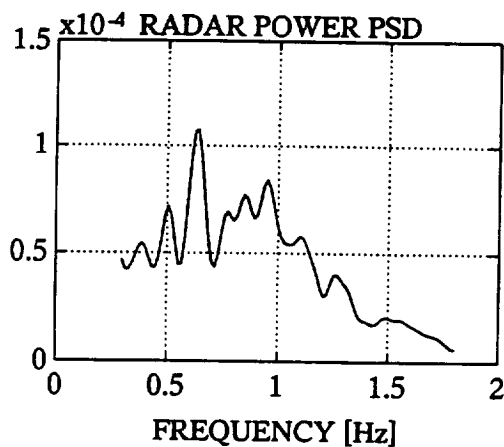
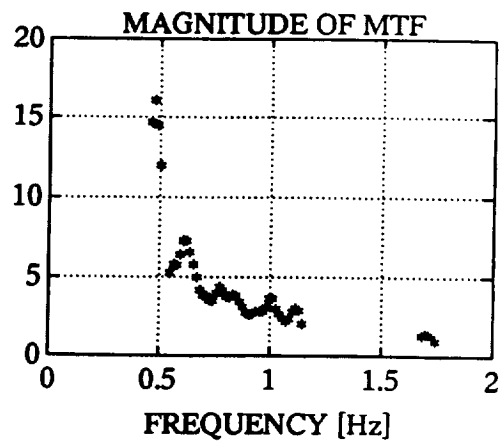
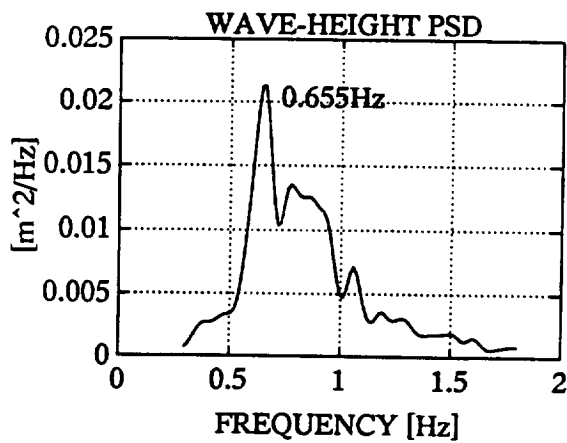
Aug. 3, 1989, Run Time : 19:19:56, Run # 13, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 19.6 deg C, Water Temp. : 20.8 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



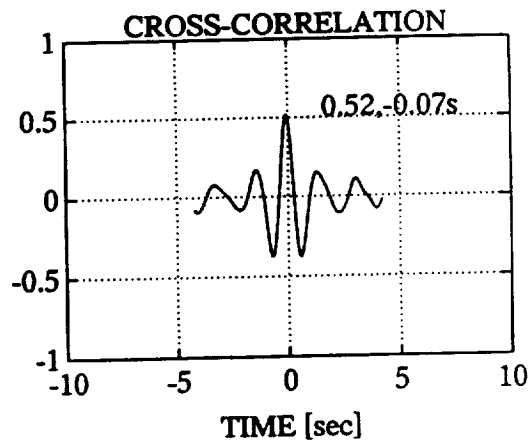
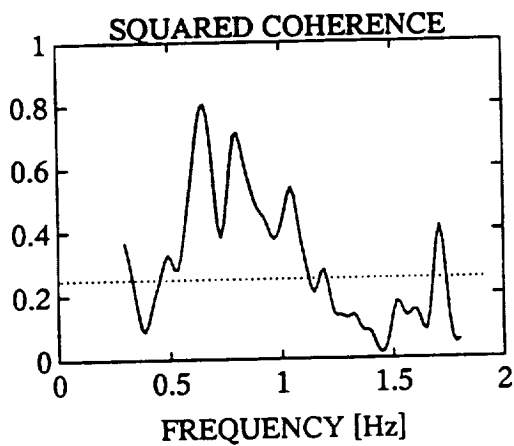
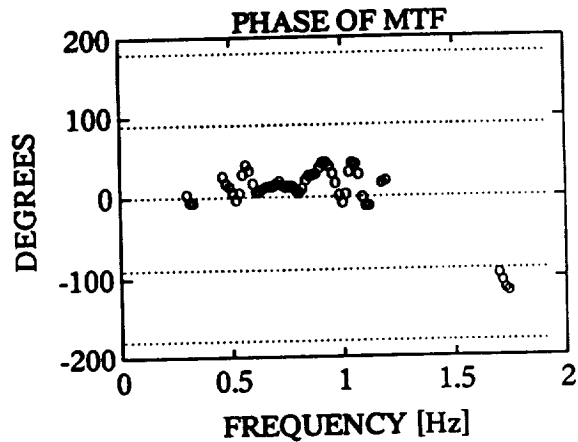
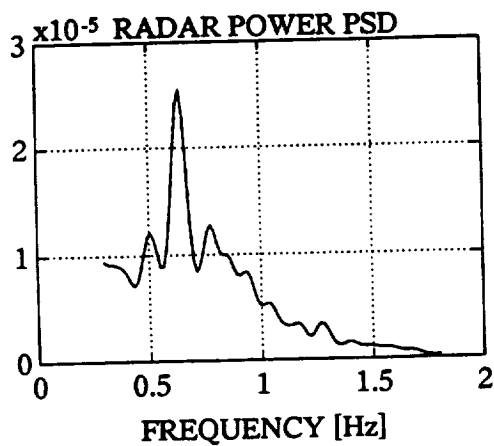
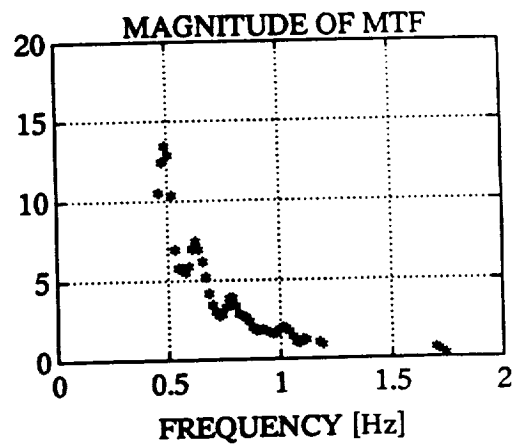
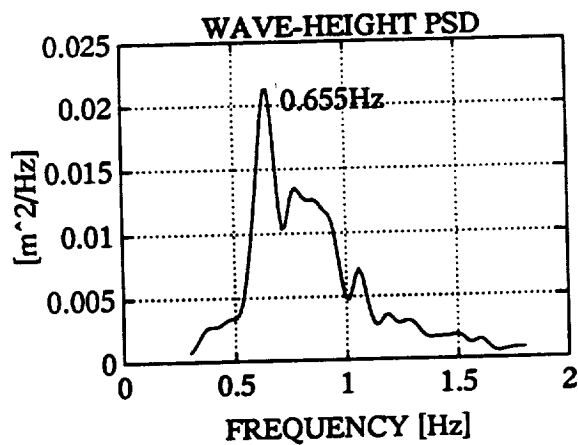
Aug. 3, 1989, Run Time : 19:25:43, Run # 14, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.21 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



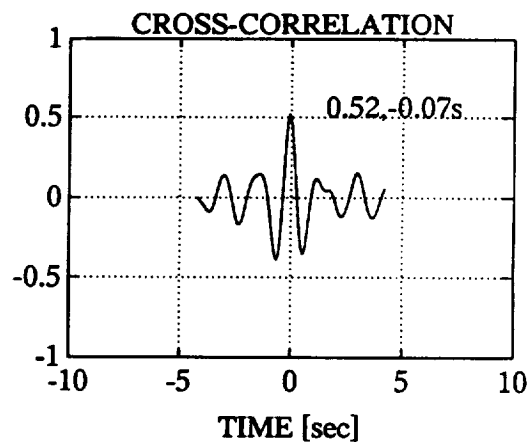
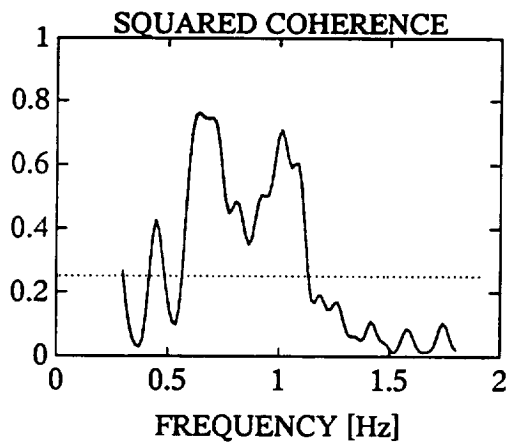
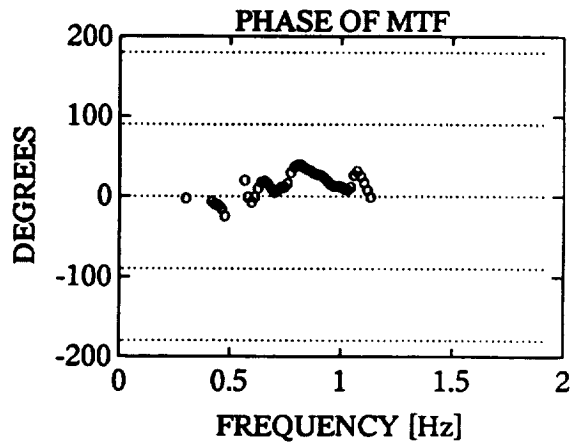
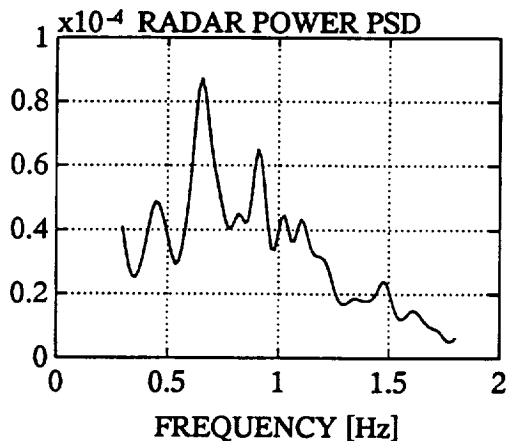
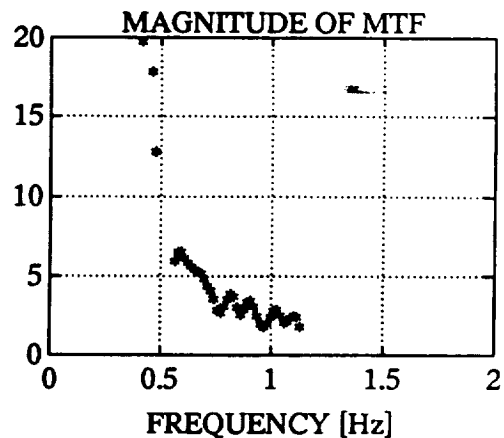
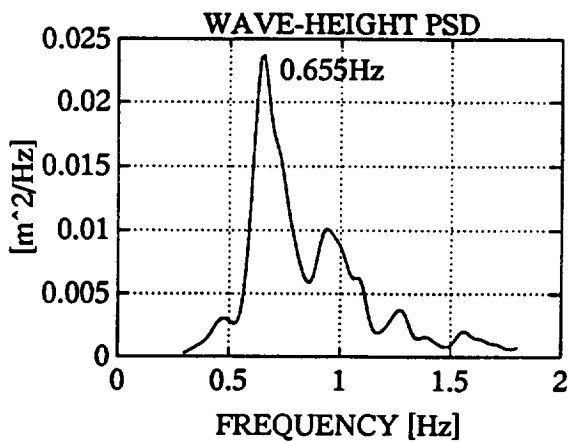
Aug. 3, 1989, Run Time : 19:25:43, Run # 14, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.21 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



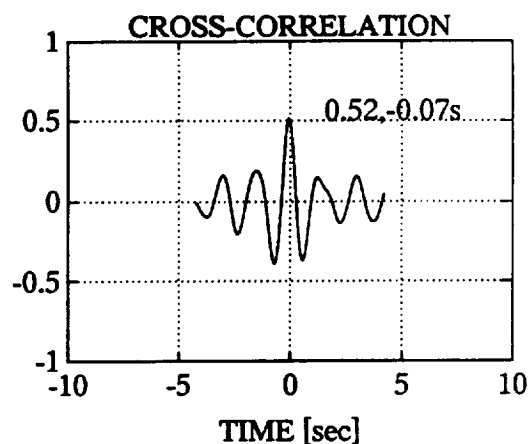
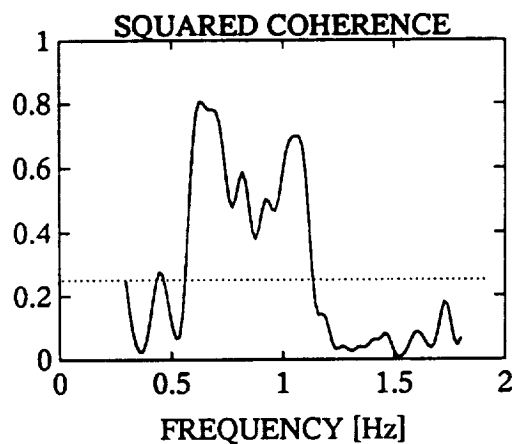
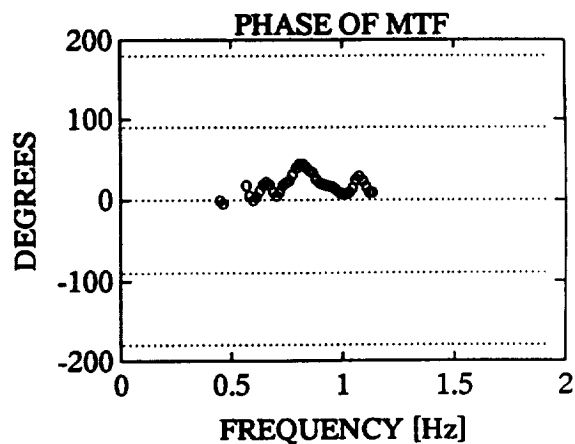
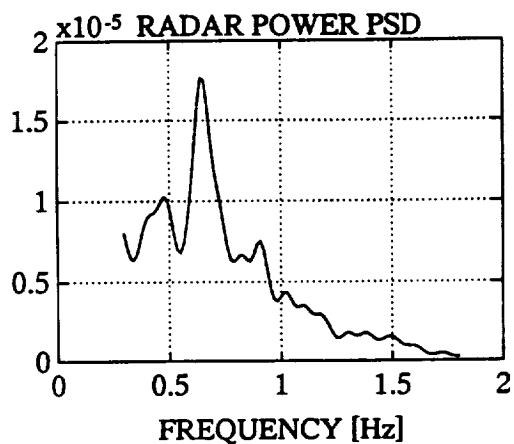
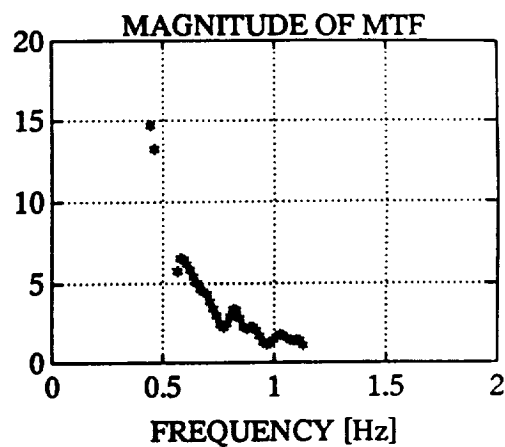
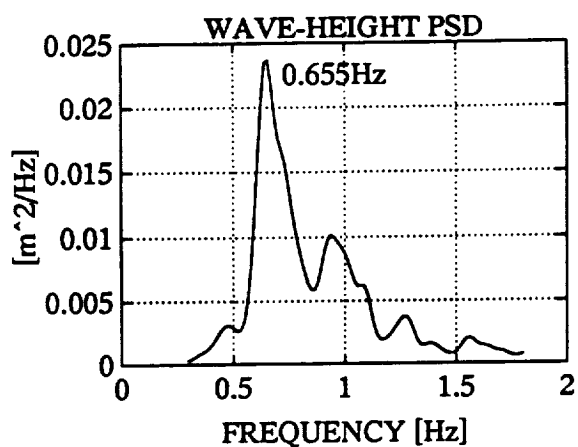
Aug. 3, 1989, Run Time : 19:31:29, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.24 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



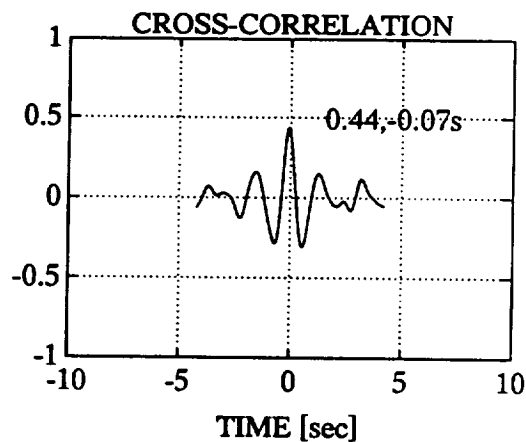
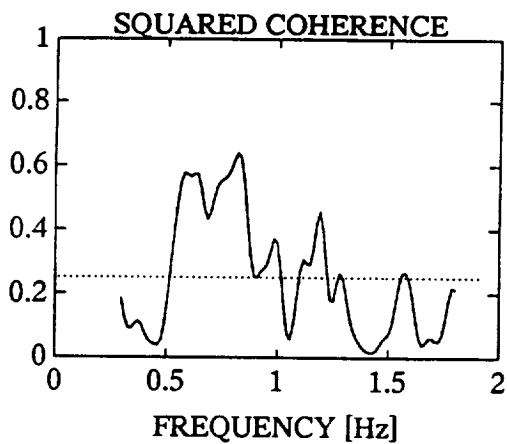
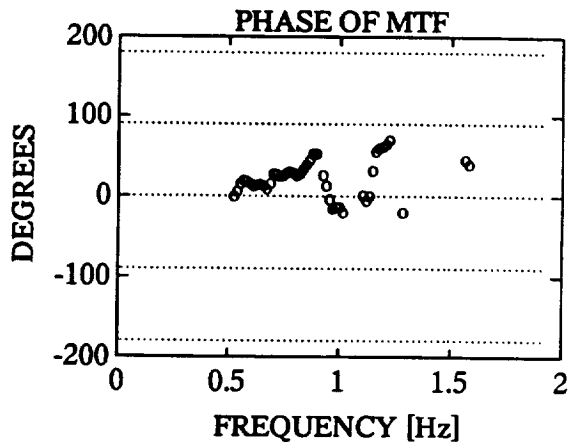
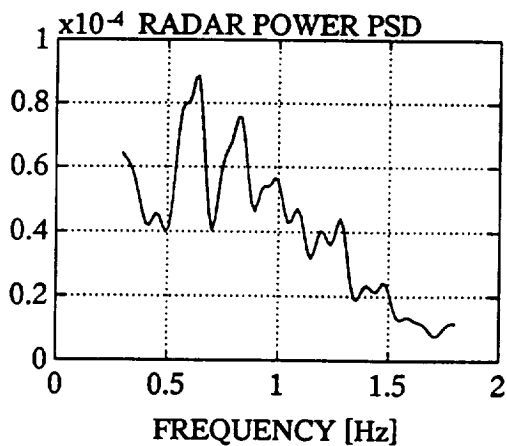
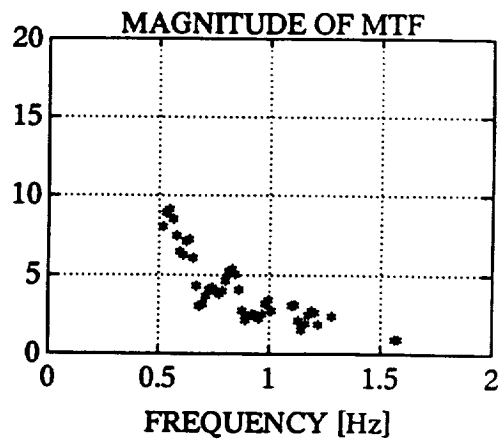
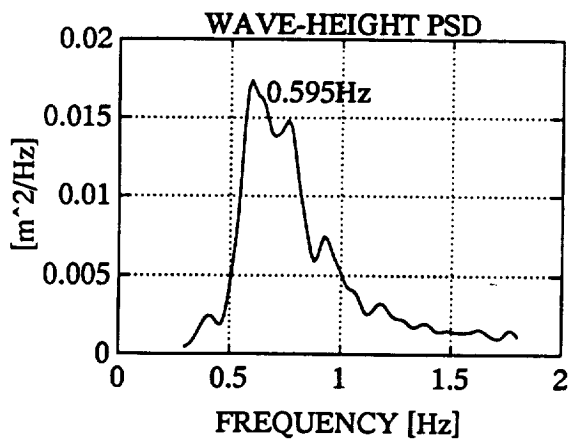
Aug. 3, 1989, Run Time : 19:31:29, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.24 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



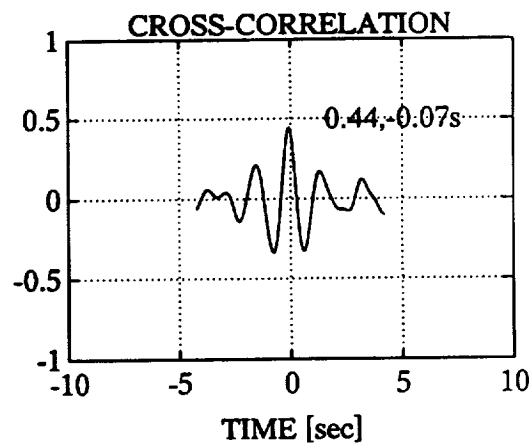
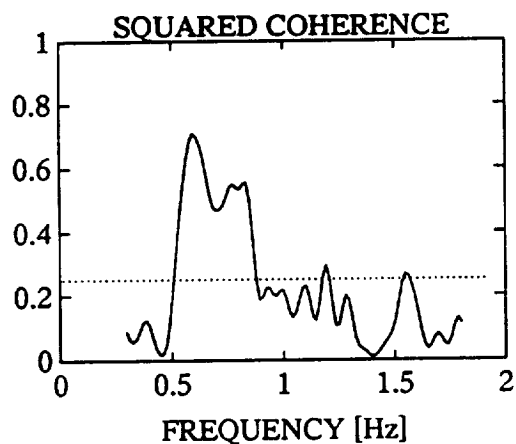
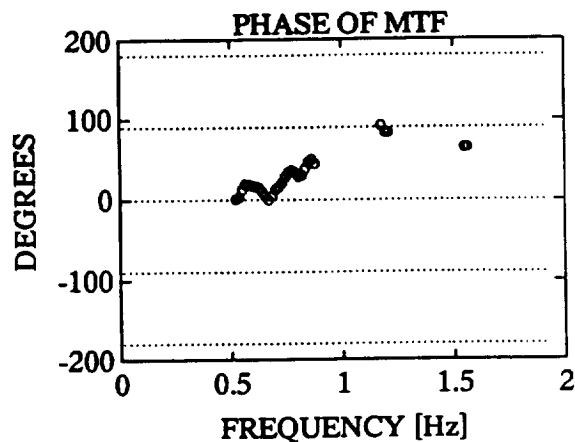
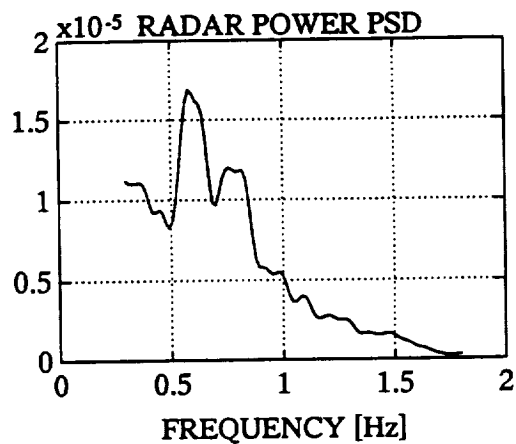
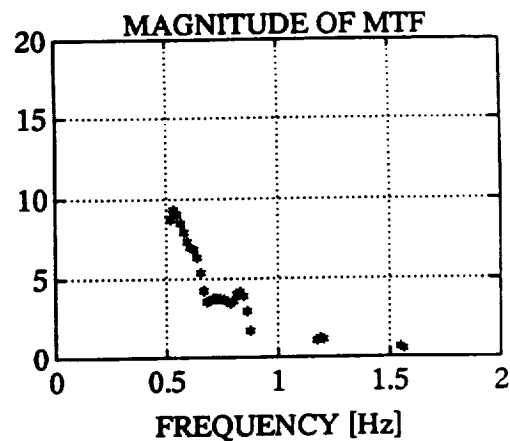
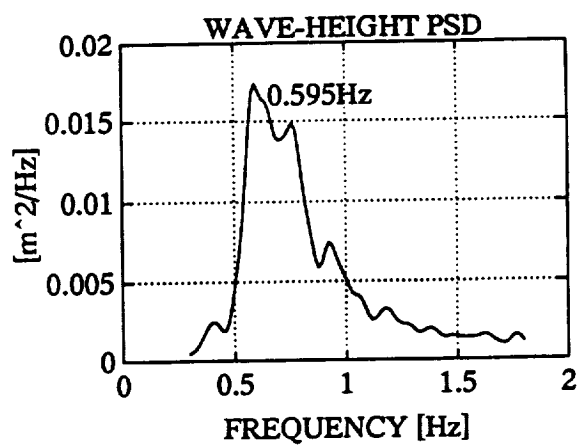
Aug. 3, 1989, Run Time : 19:37: 5, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.65 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



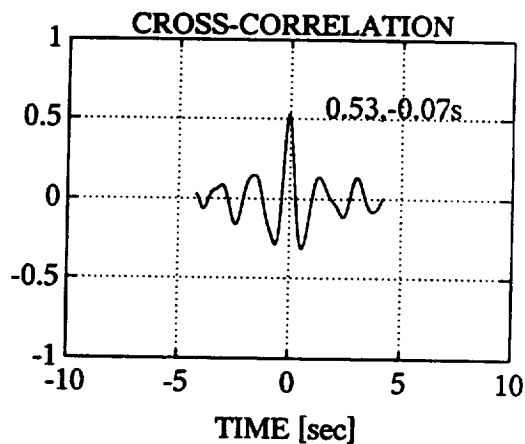
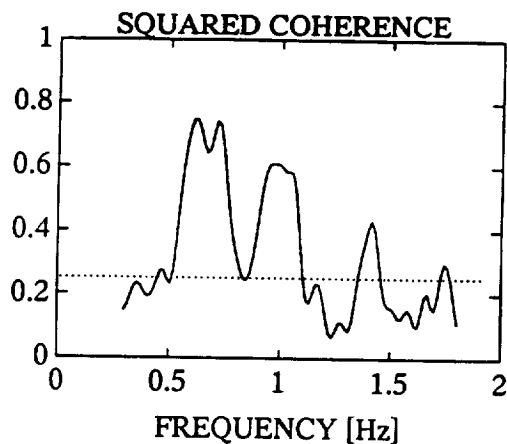
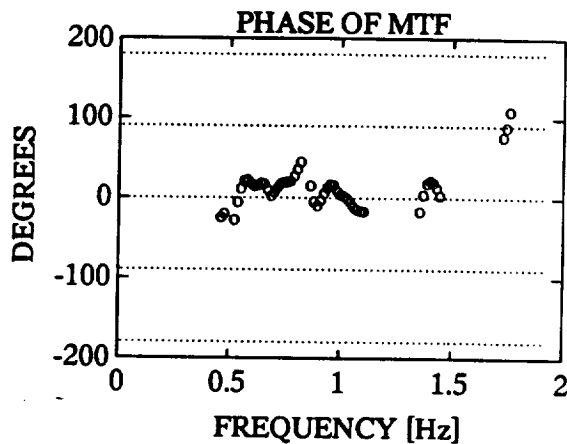
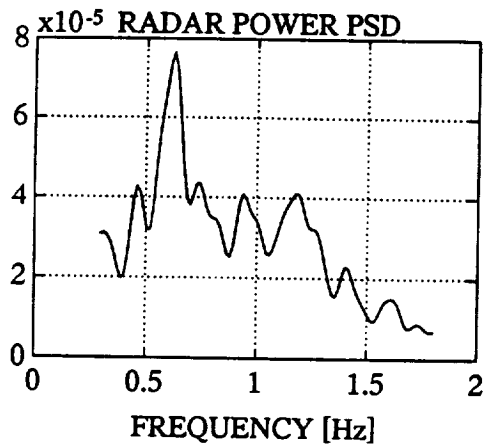
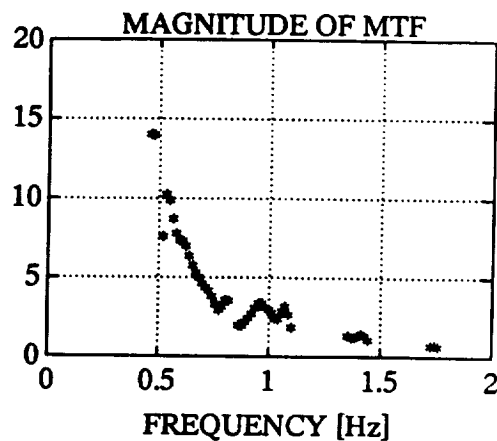
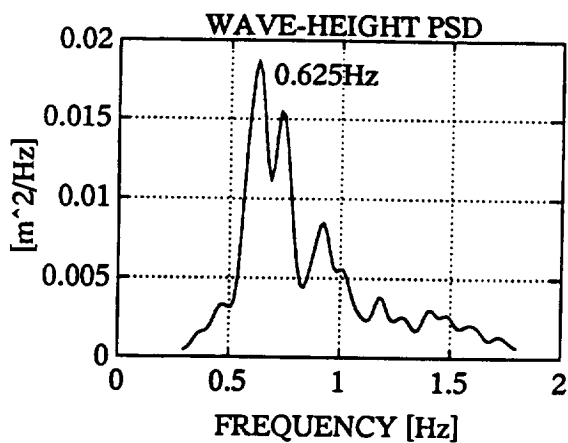
Aug. 3, 1989, Run Time : 19:37: 5, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.65 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



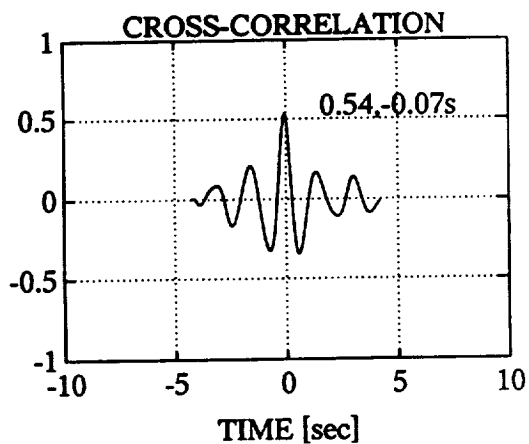
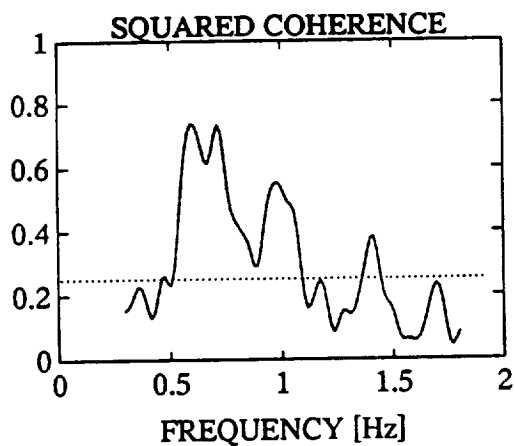
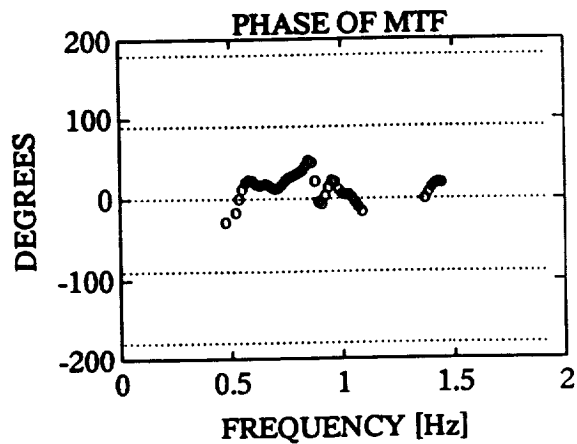
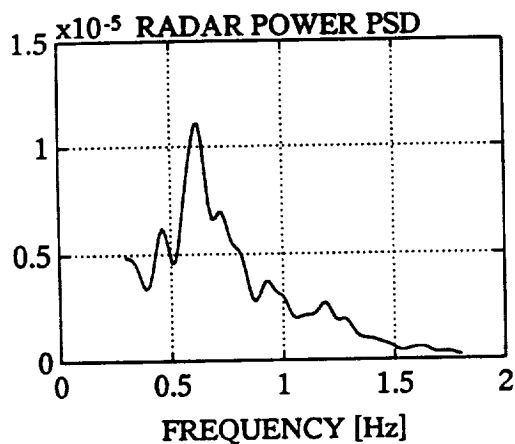
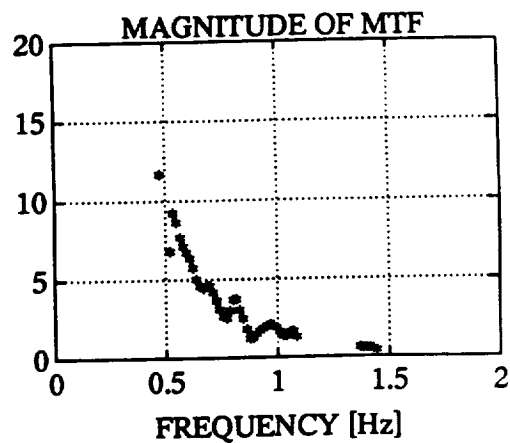
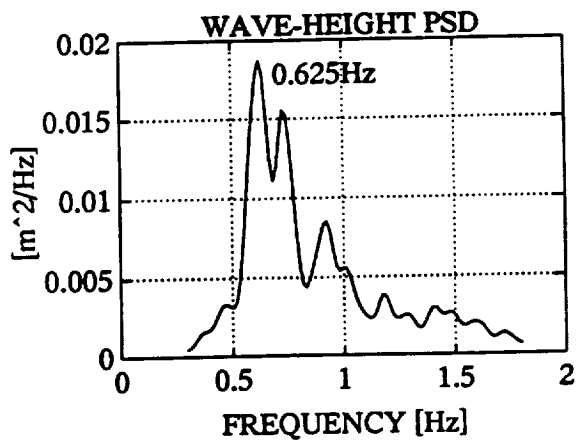
Aug. 3, 1989, Run Time : 19:42:38, Run # 17, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.83 m/s, Air Temp. : 19.2 deg C, Water Temp. : 20.7 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



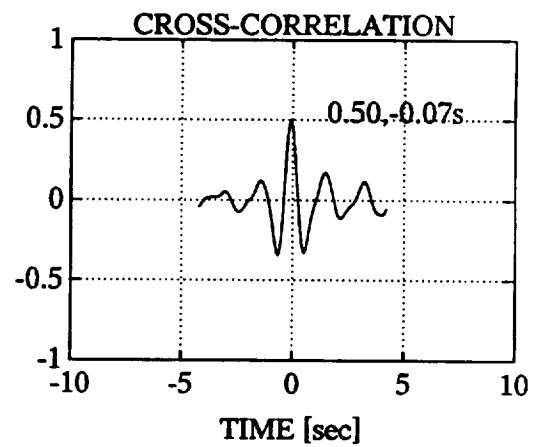
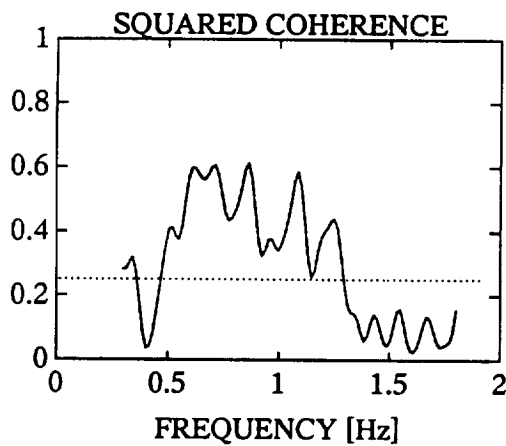
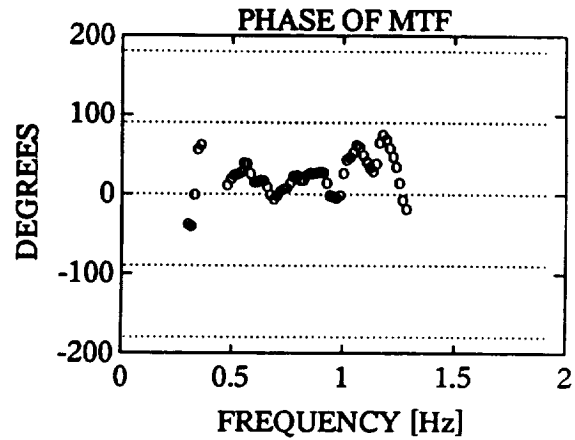
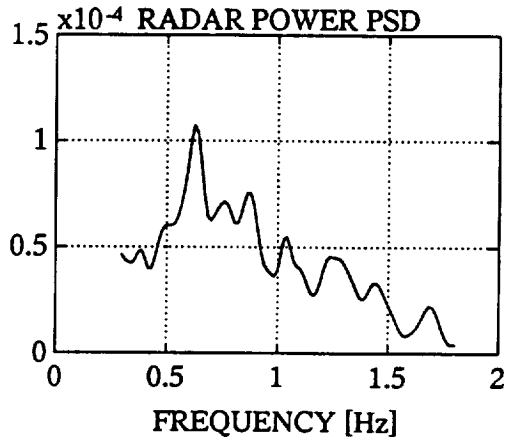
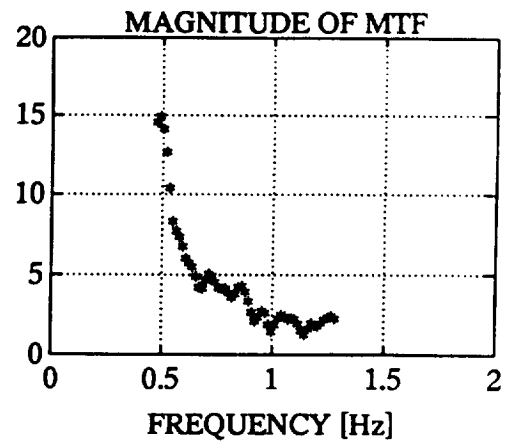
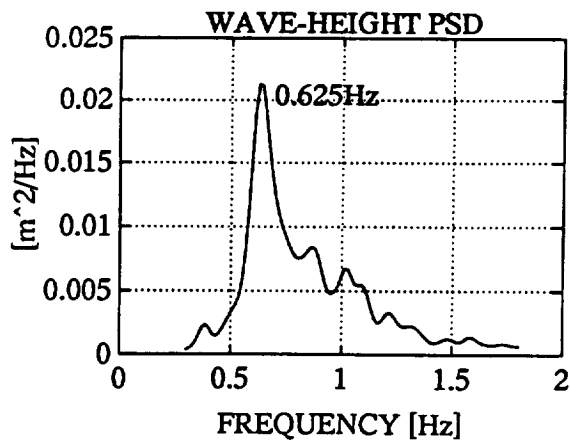
Aug. 3, 1989, Run Time : 19:42:38, Run # 17, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.83 m/s, Air Temp. : 19.2 deg C, Water Temp. : 20.7 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



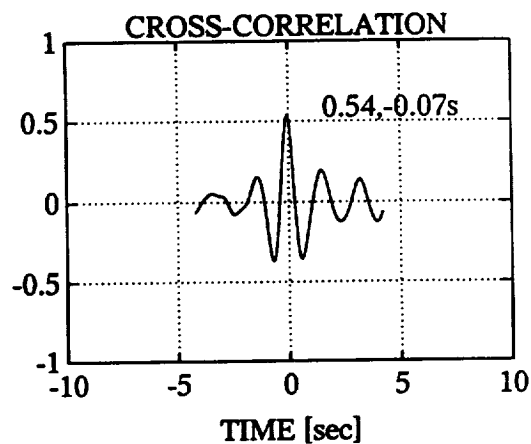
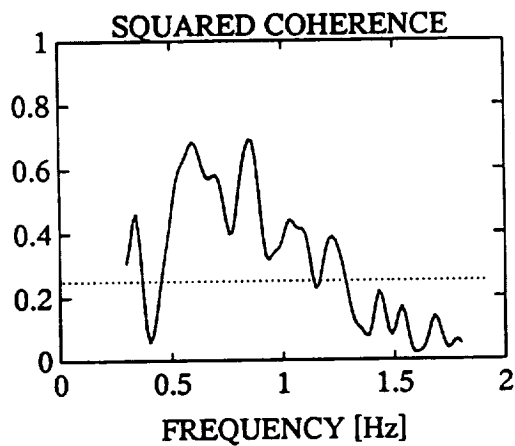
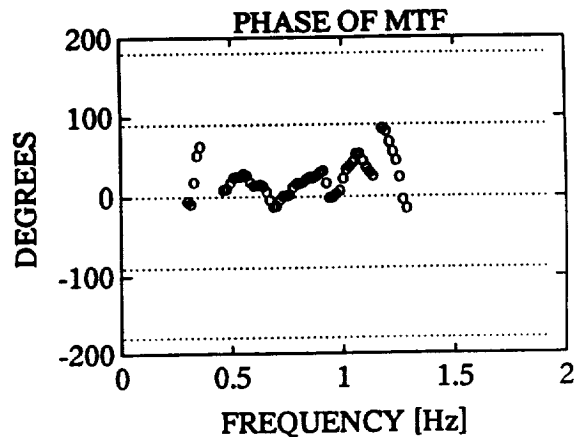
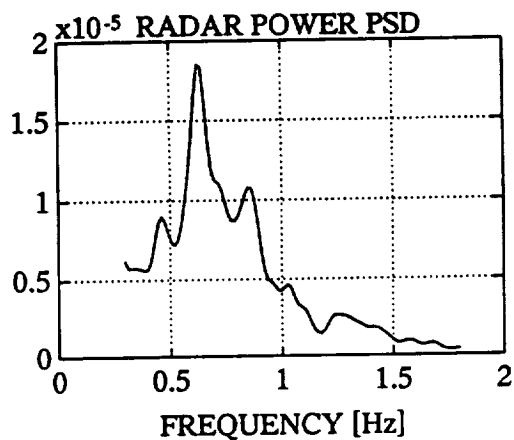
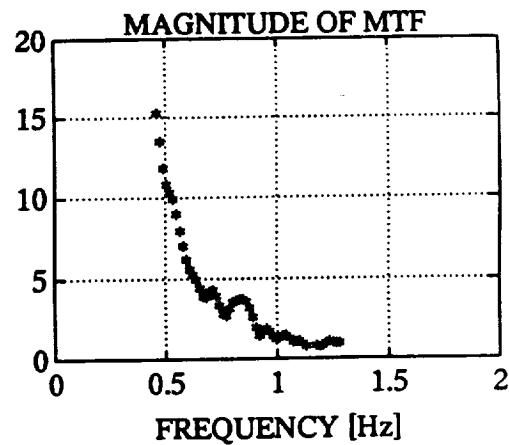
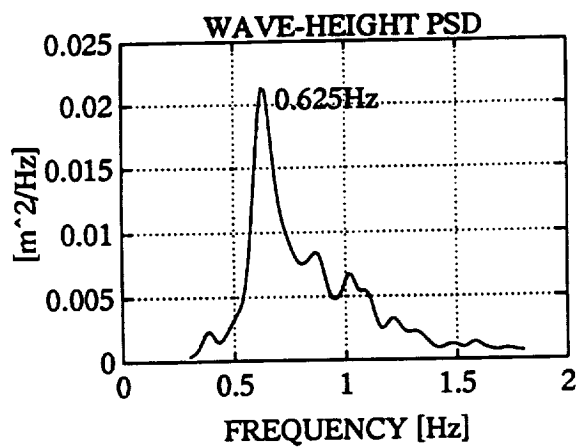
Aug. 3, 1989, Run Time : 19:48:10, Run # 18, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 19.2 deg C, Water Temp. : 20.7 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



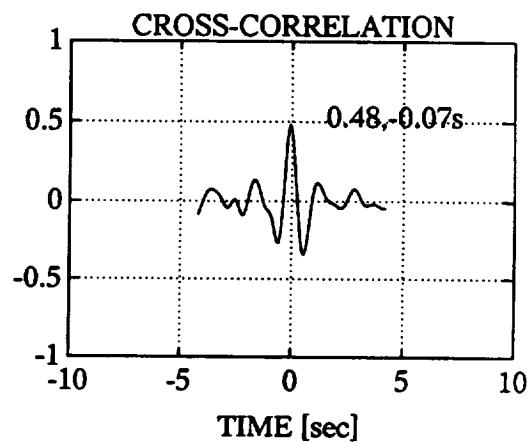
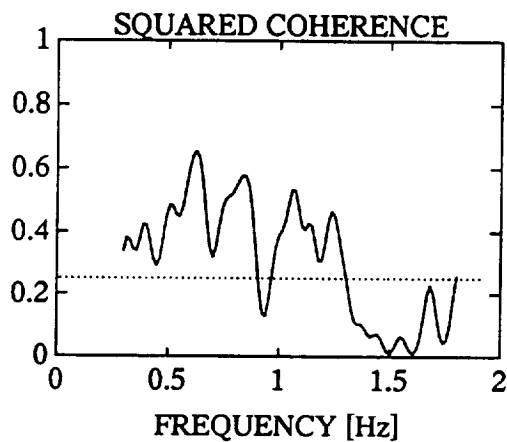
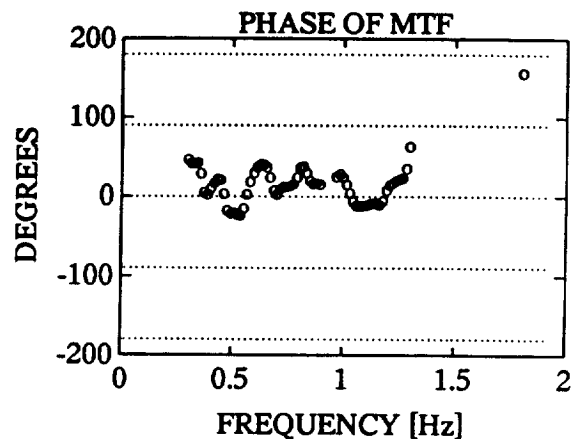
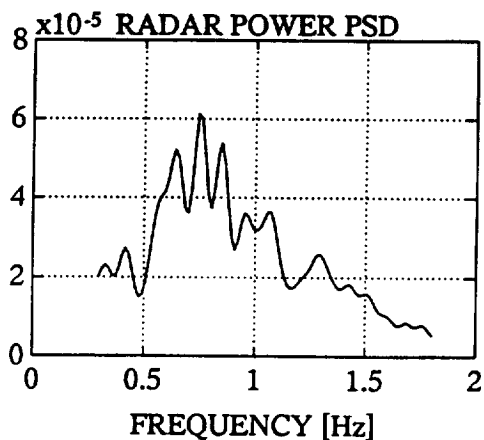
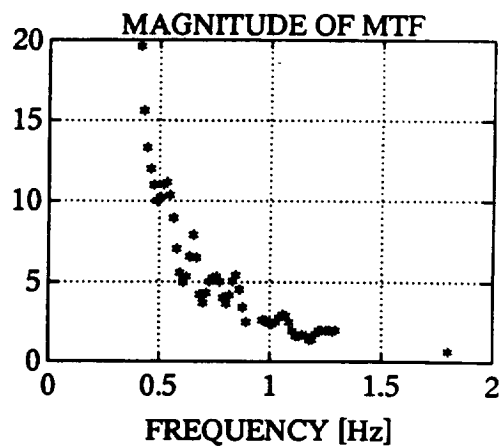
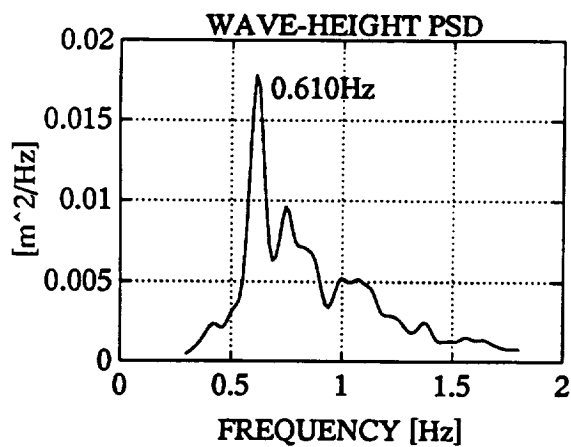
Aug. 3, 1989, Run Time : 19:48:10, Run # 18, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.23 m/s, Air Temp. : 19.2 deg C, Water Temp. : 20.7 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



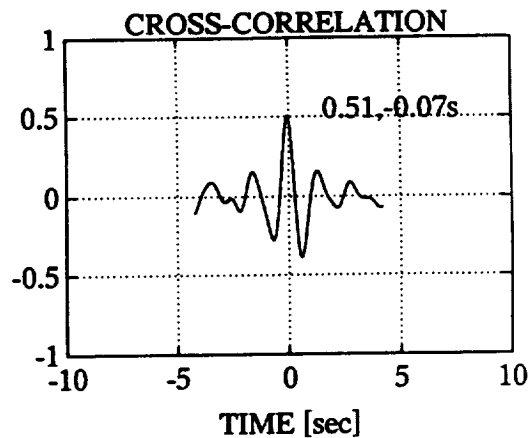
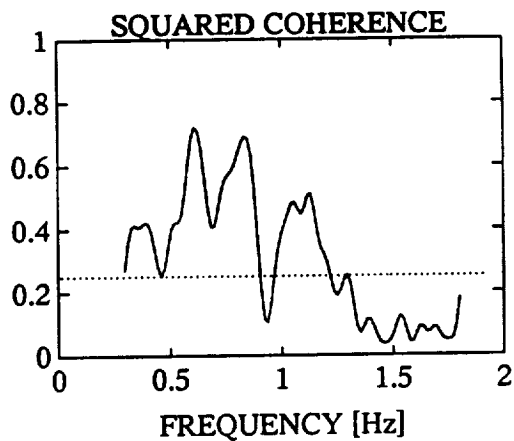
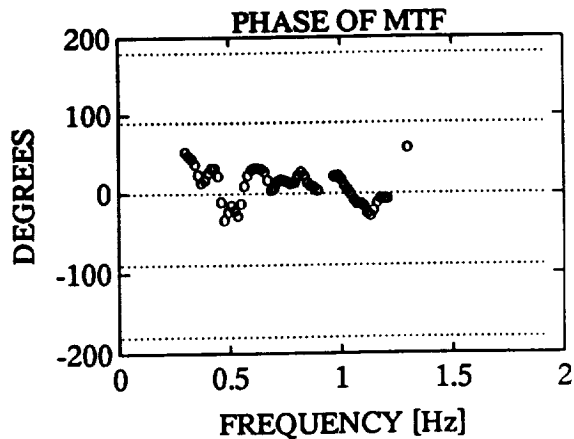
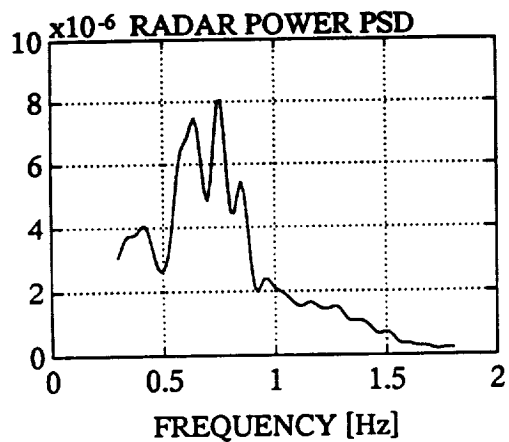
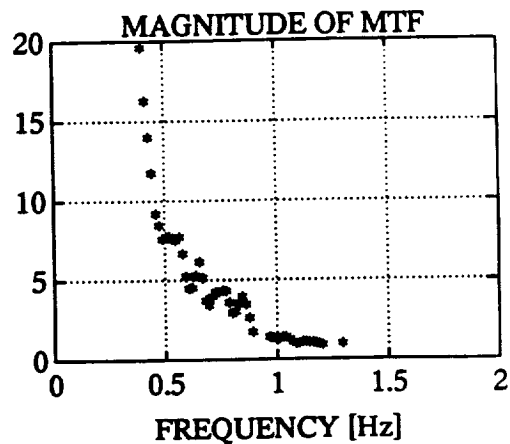
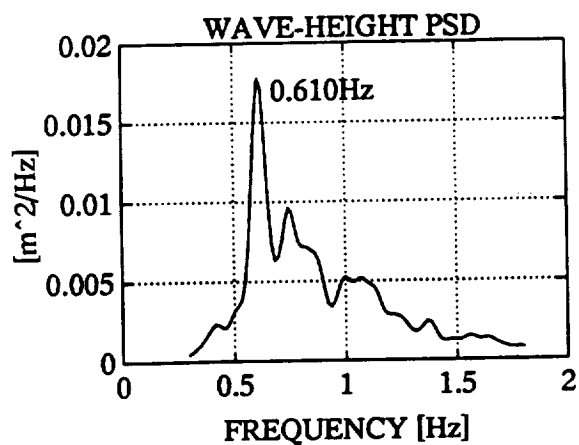
Aug. 3, 1989, Run Time : 19:54: 5, Run # 19, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.38 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



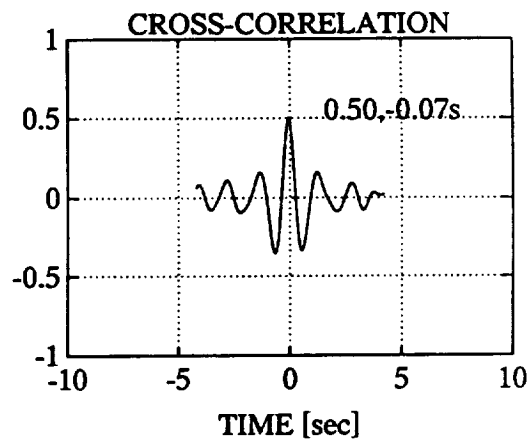
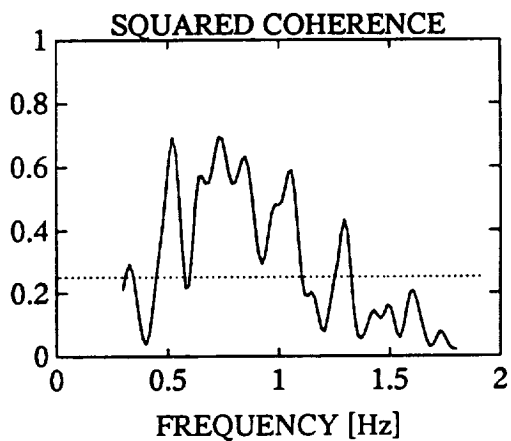
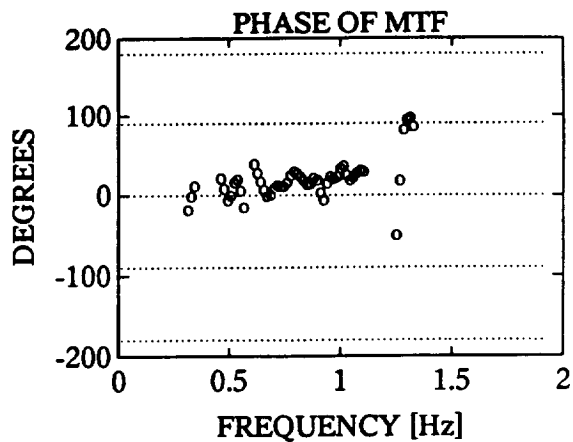
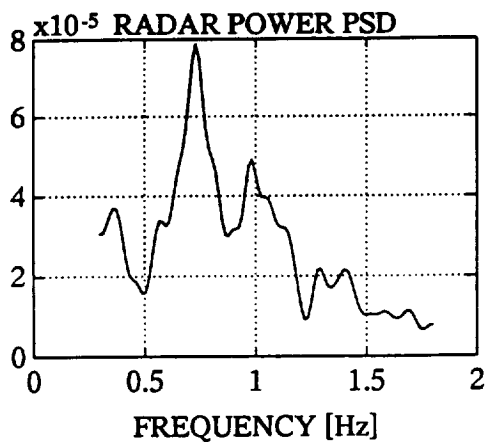
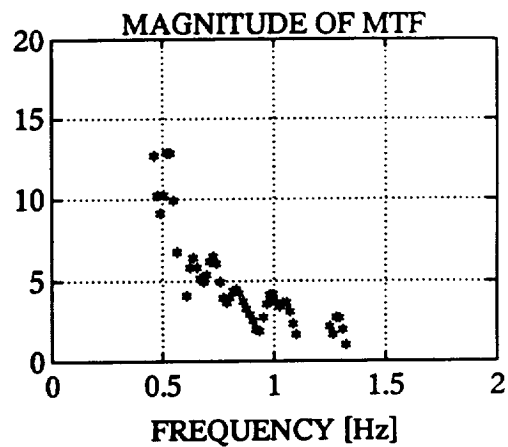
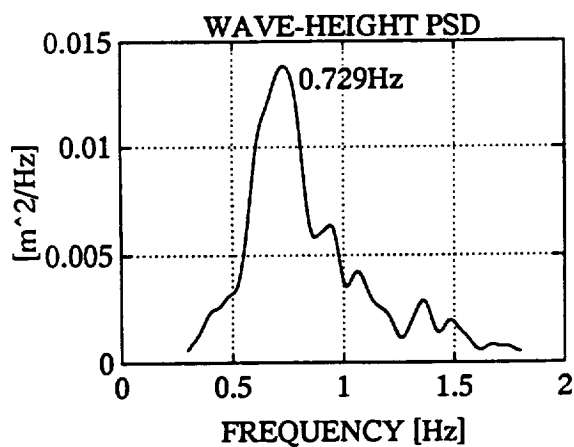
Aug. 3, 1989, Run Time : 19:54: 5, Run # 19, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.38 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



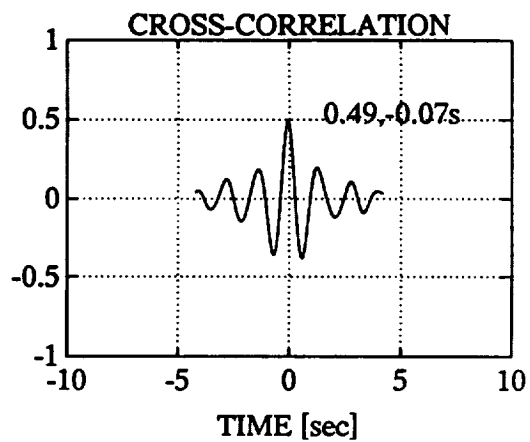
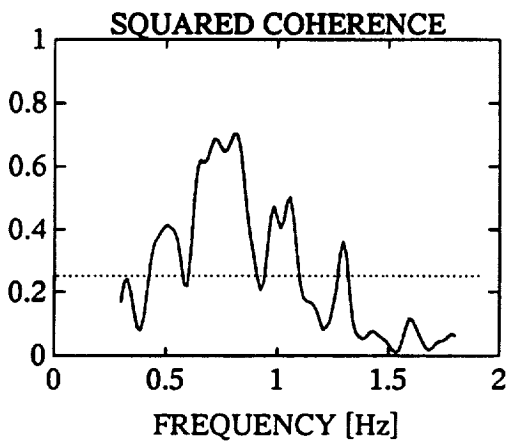
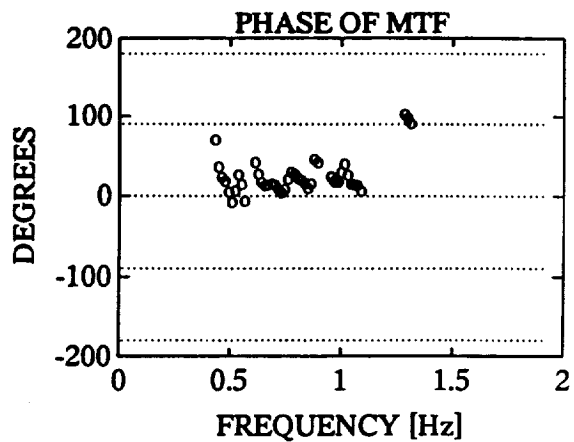
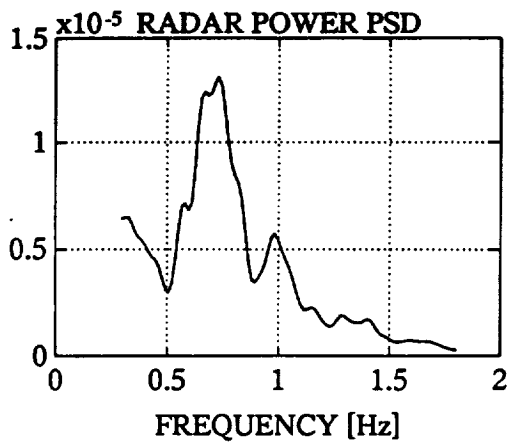
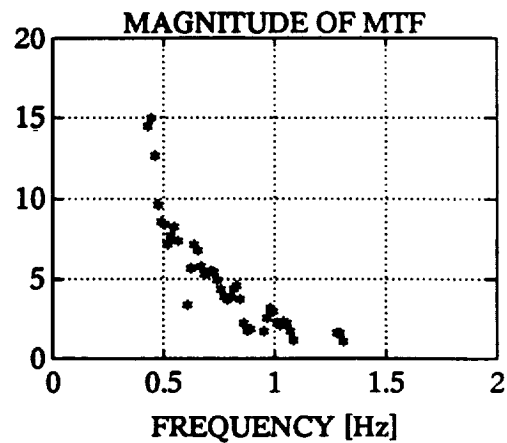
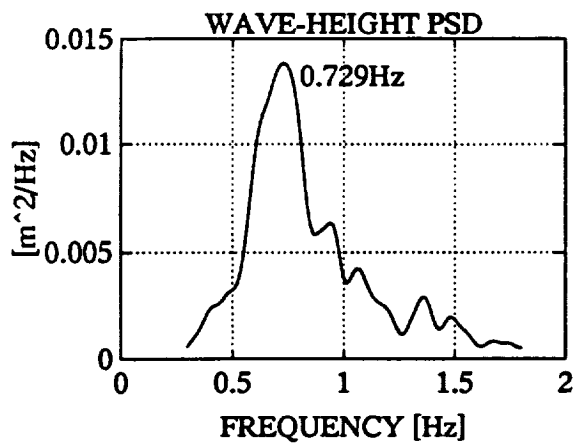
Aug. 3, 1989, Run Time : 19:59:43, Run # 20, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



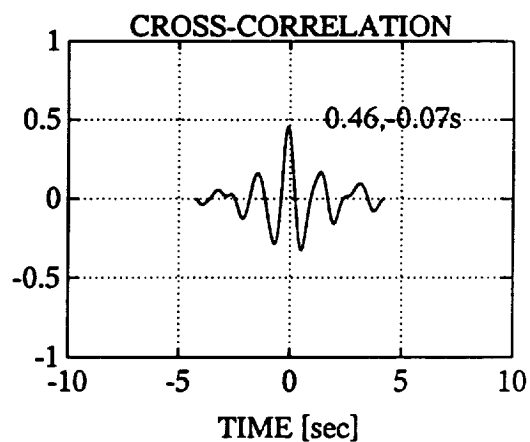
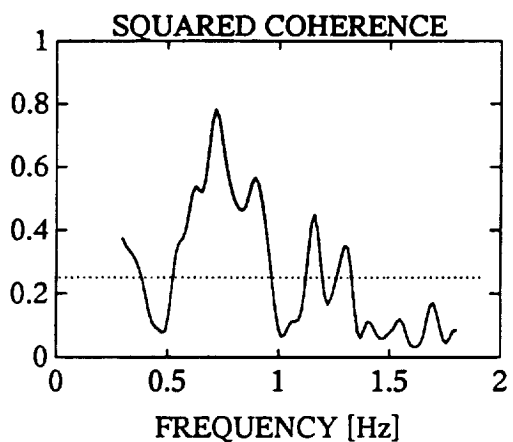
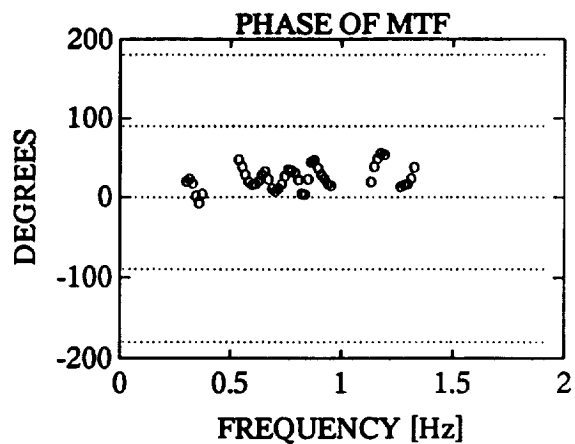
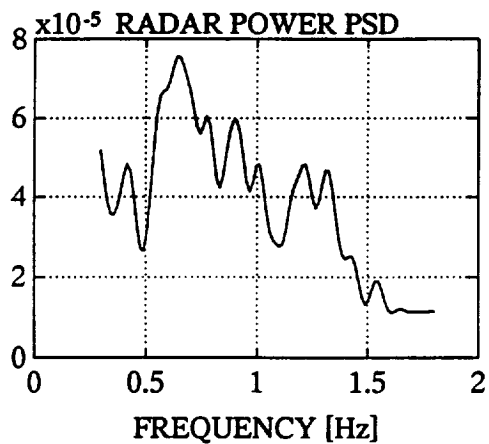
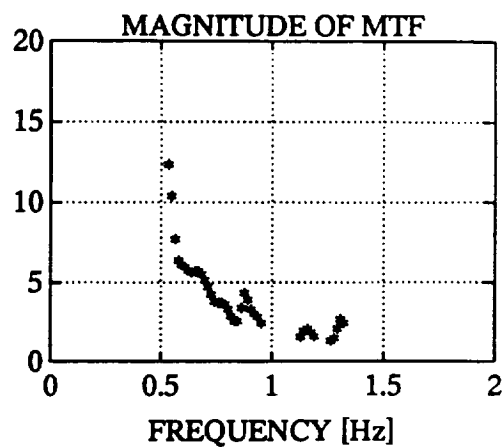
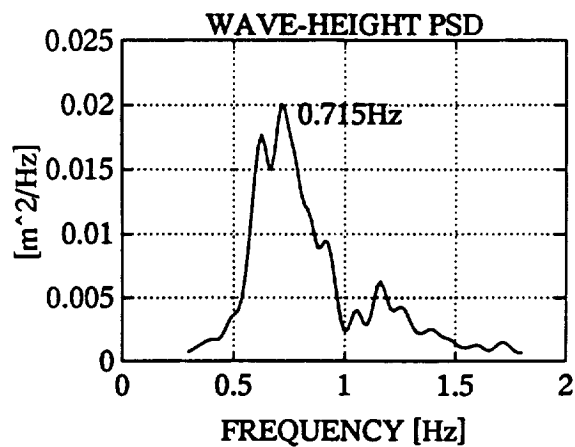
Aug. 3, 1989, Run Time : 19:59:43, Run # 20, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 19.9 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



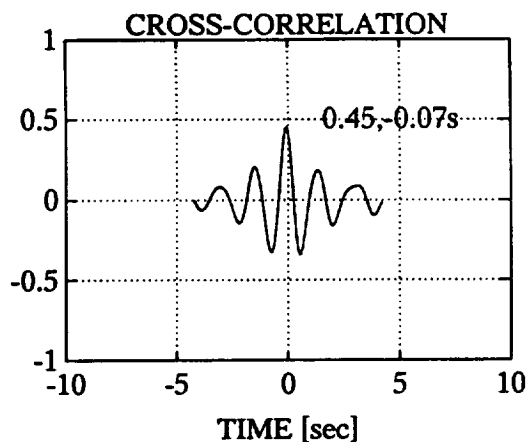
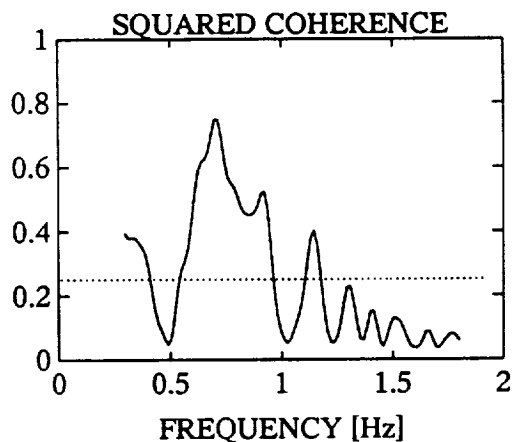
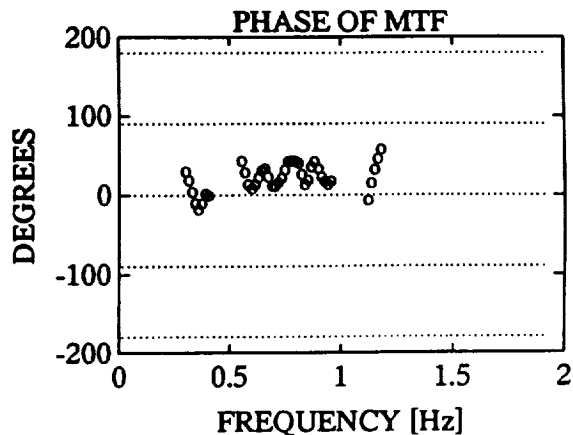
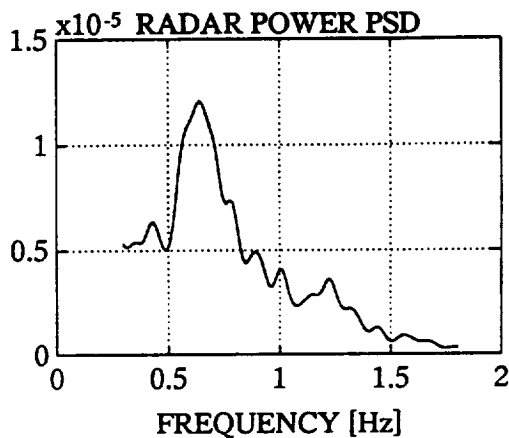
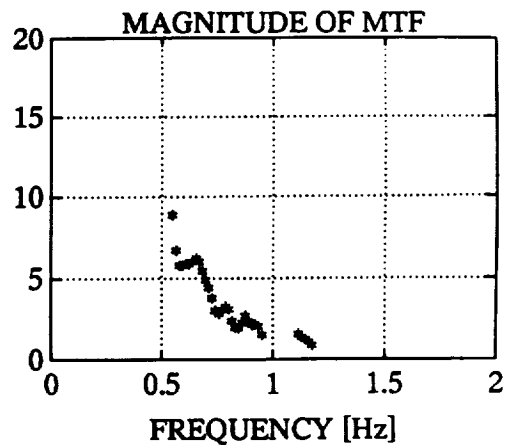
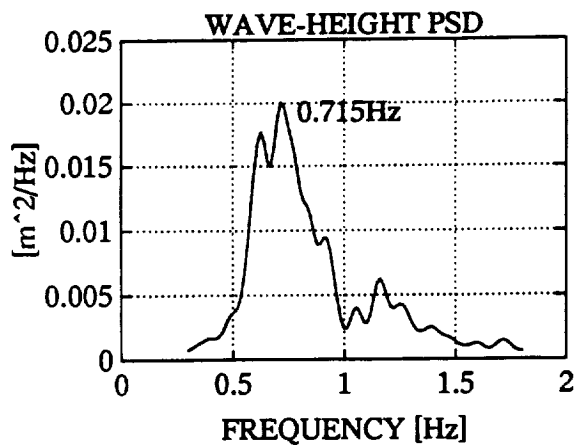
Aug. 3, 1989, Run Time : 20: 5:22, Run # 21, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 19.8 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



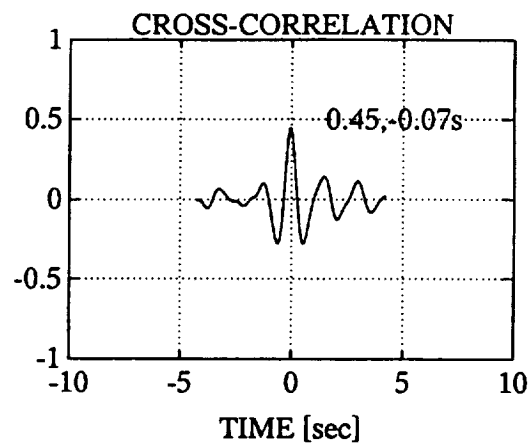
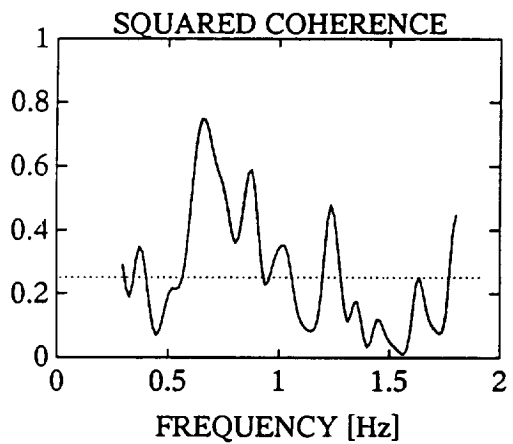
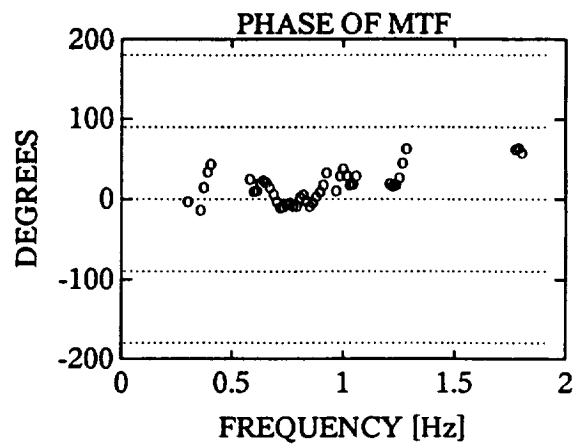
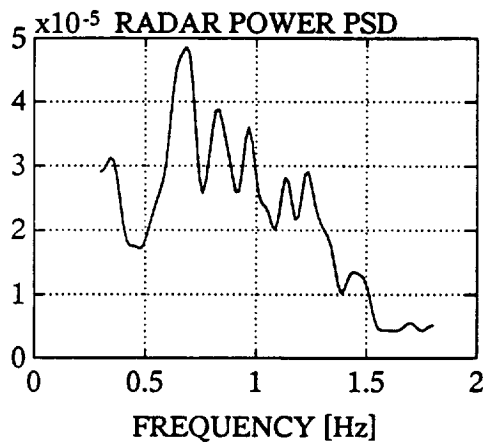
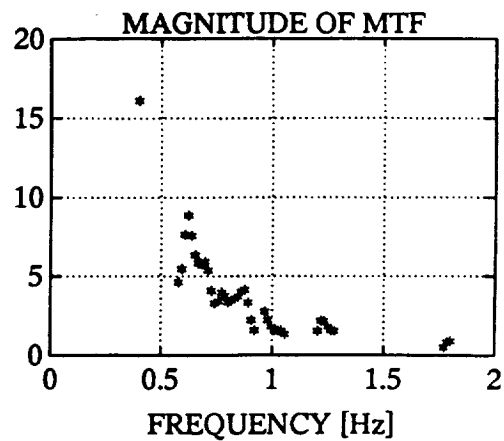
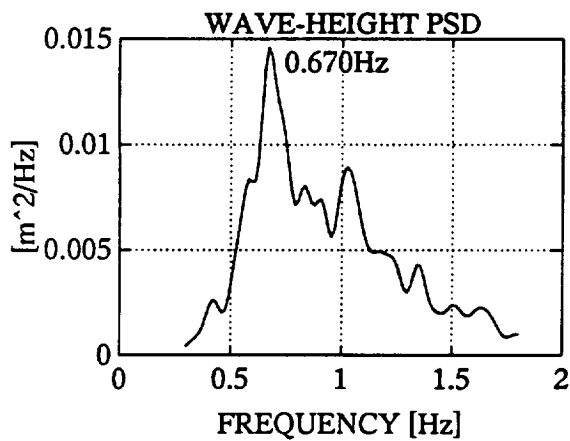
Aug. 3, 1989, Run Time : 20: 5:22, Run # 21, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 19.8 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



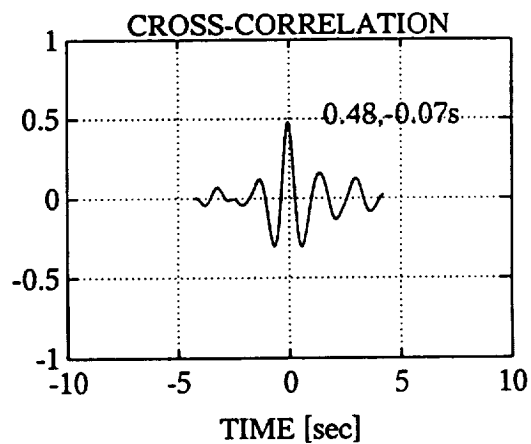
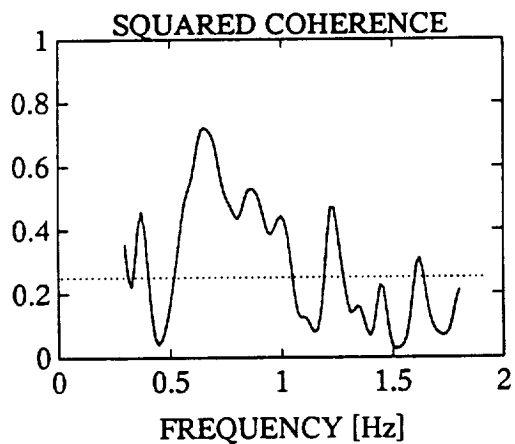
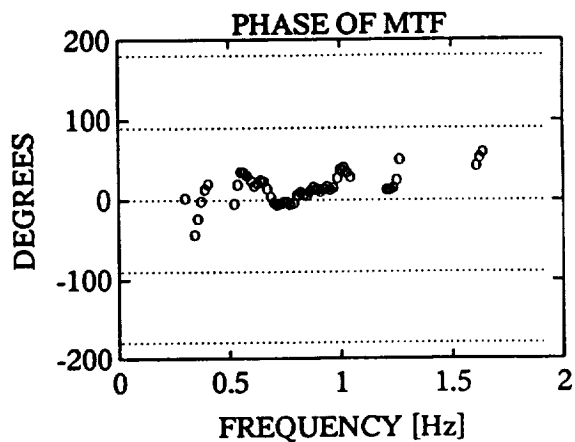
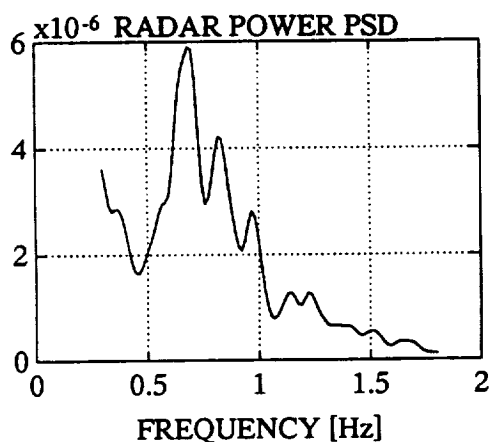
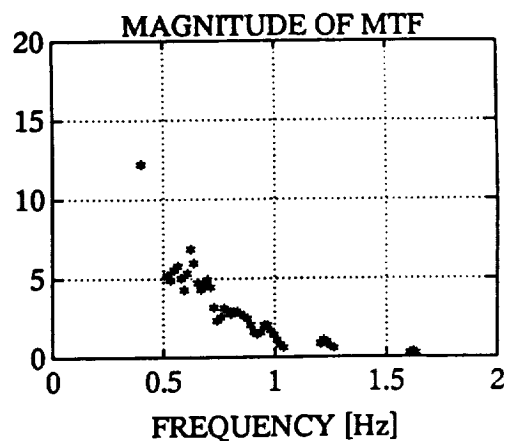
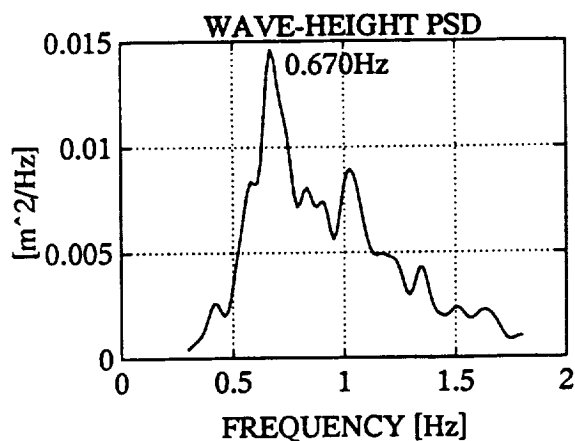
Aug. 3, 1989, Run Time : 20:16:44, Run # 23, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.87 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



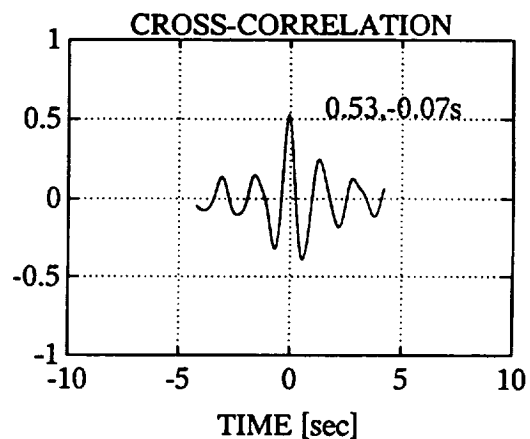
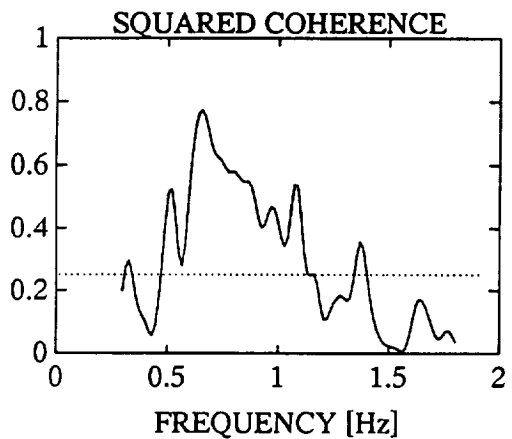
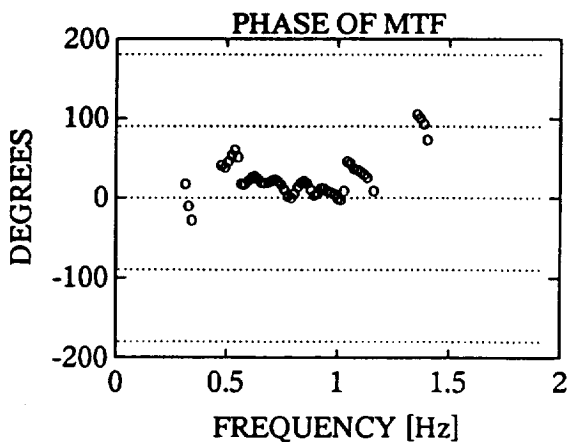
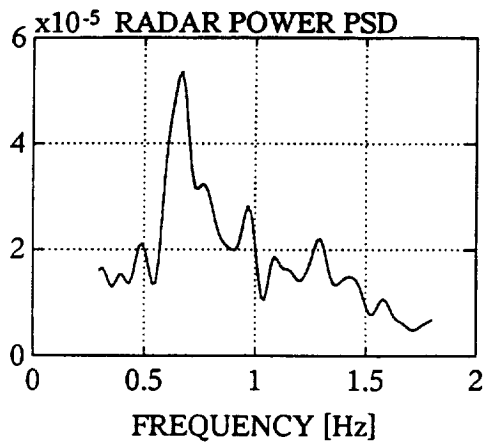
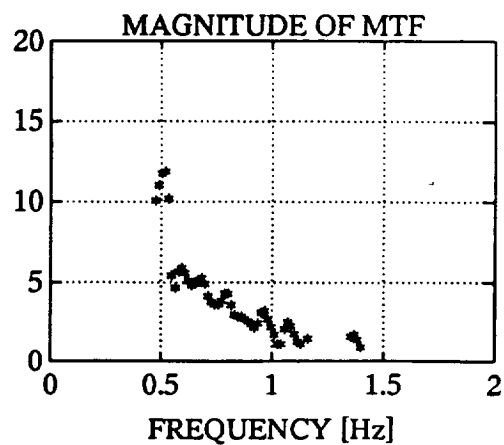
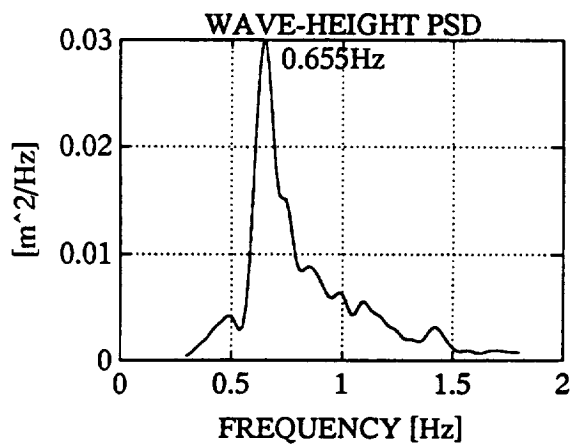
Aug. 3, 1989, Run Time : 20:16:44, Run # 23, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.87 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



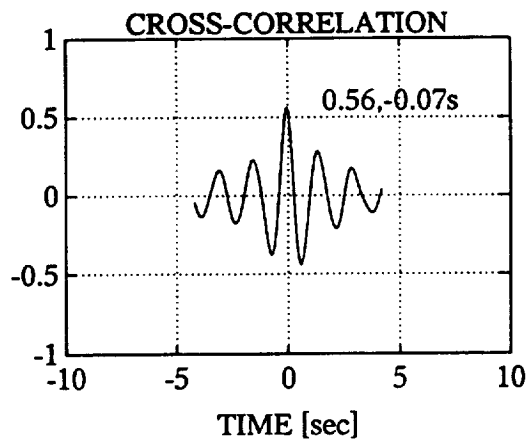
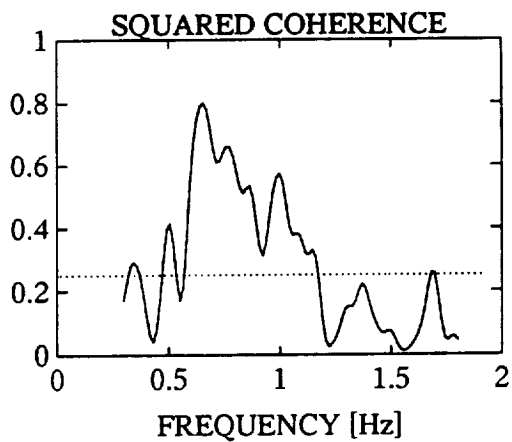
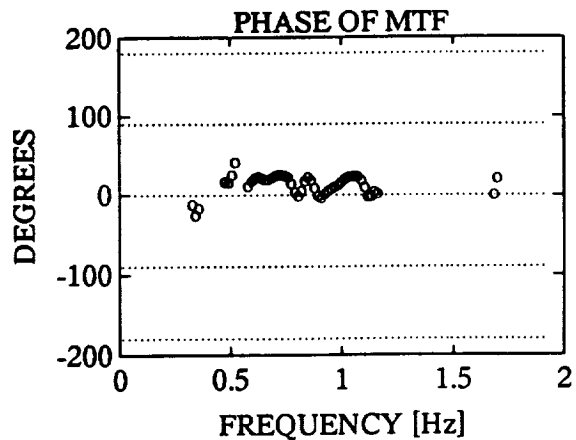
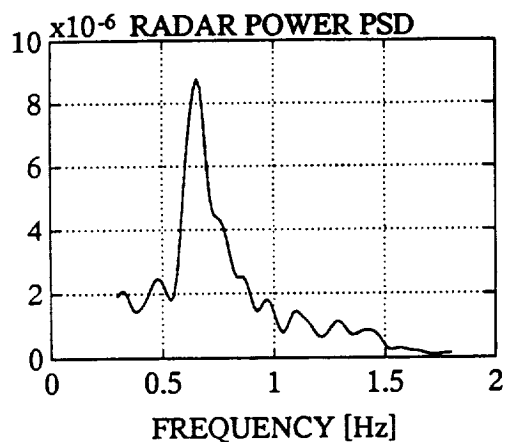
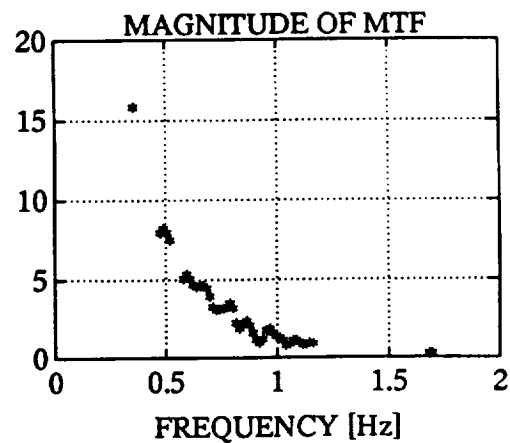
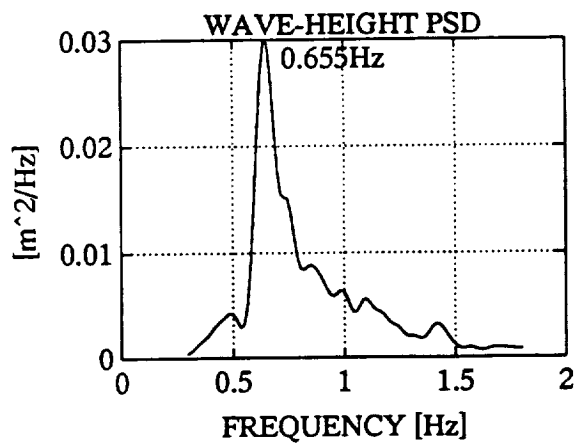
Aug. 3, 1989, Run Time : 20:22:44, Run # 24, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.78 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



Aug. 3, 1989, Run Time : 20:22:44, Run # 24, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.78 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



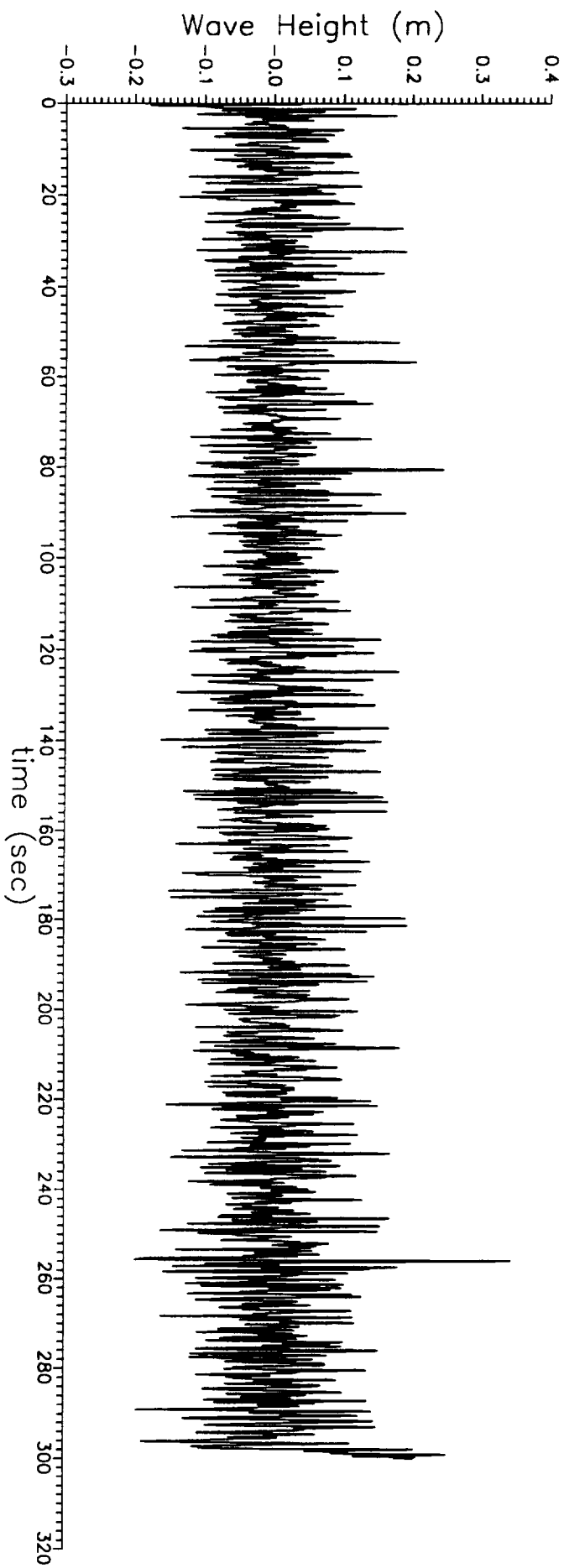
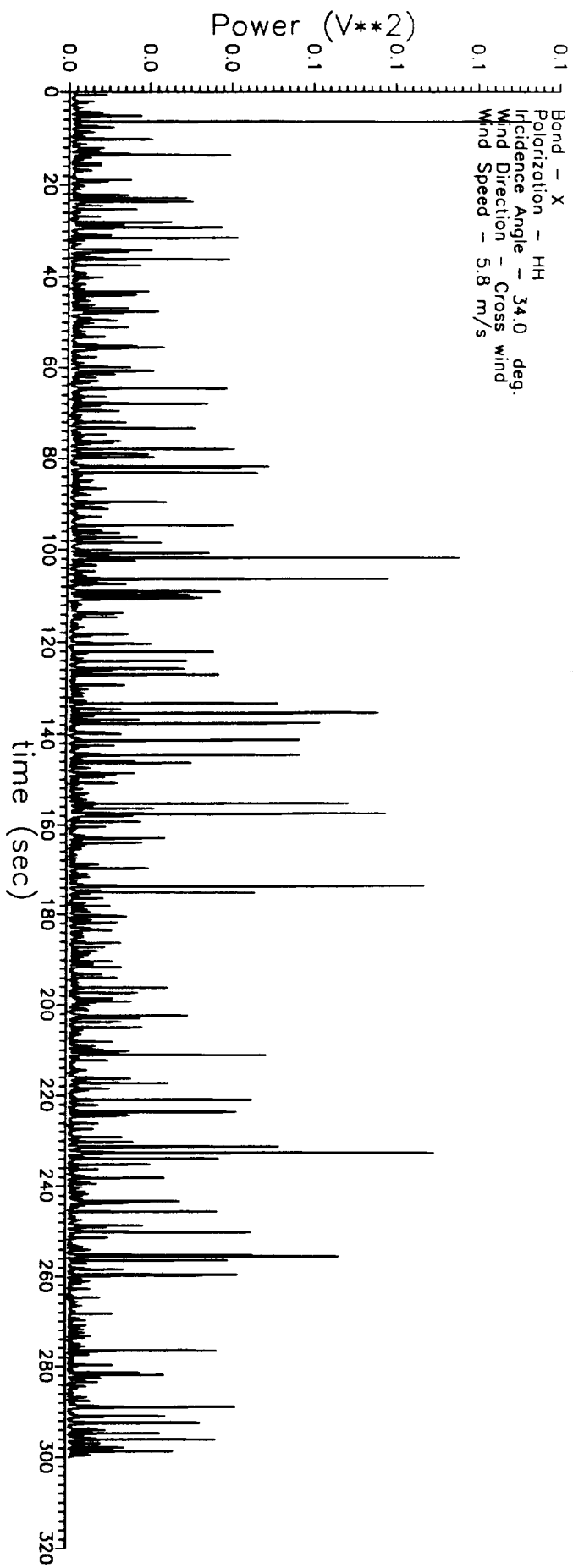
Aug. 3, 1989, Run Time : 20:28:18, Run # 25, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.58 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



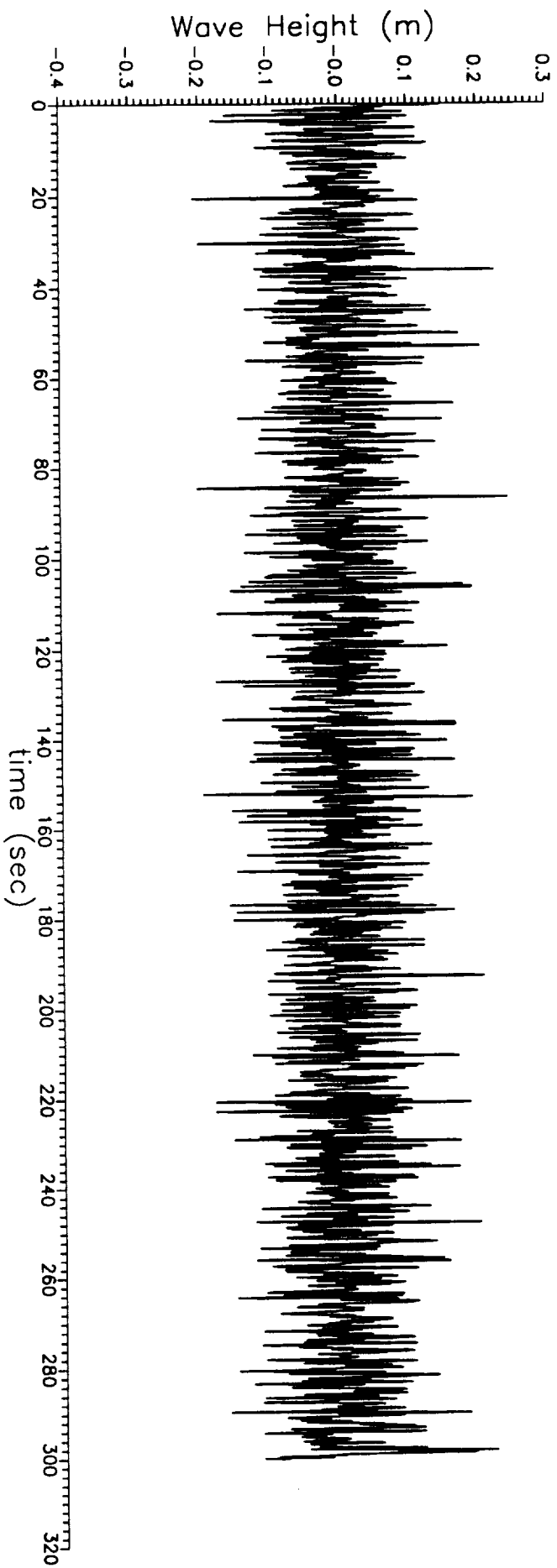
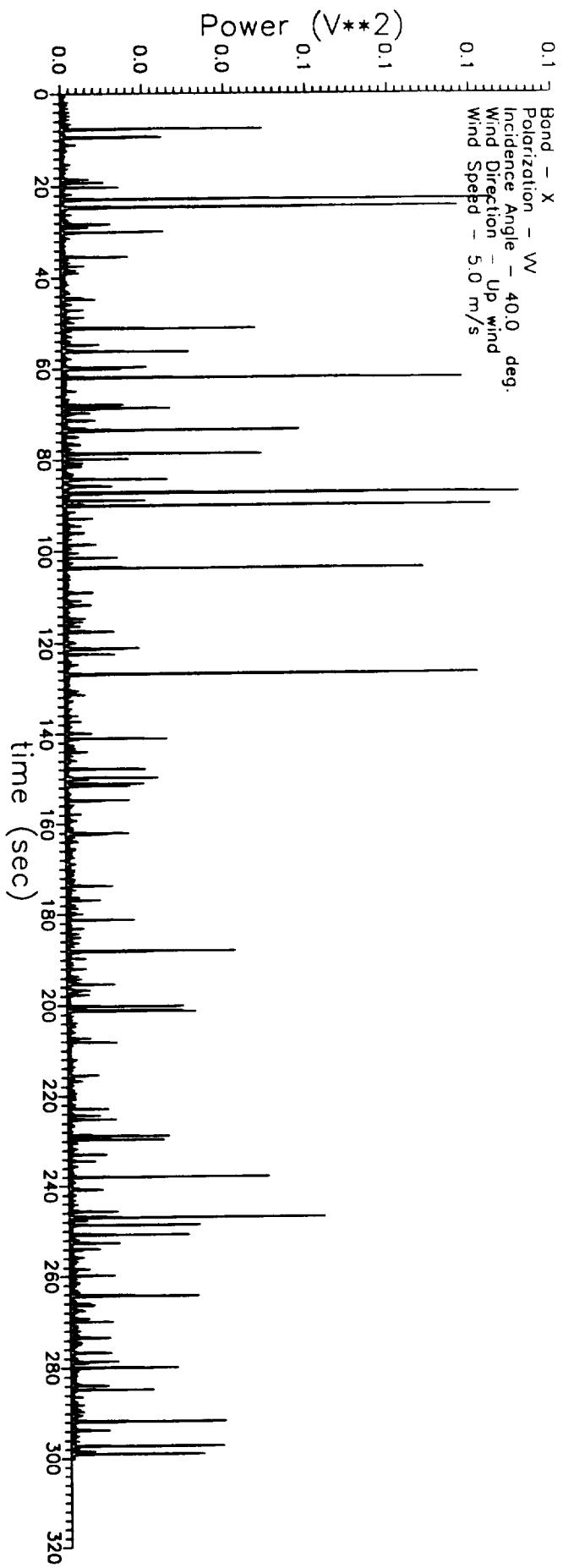
Aug. 3, 1989, Run Time : 20:28:18, Run # 25, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.58 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)

Run 15, 18:53, Aug 7, 1989

Bond - X
Polarization - HH
Incidence Angle - 34.0 deg.
Wind Direction - Cross wind
Wind Speed - 5.8 m/s

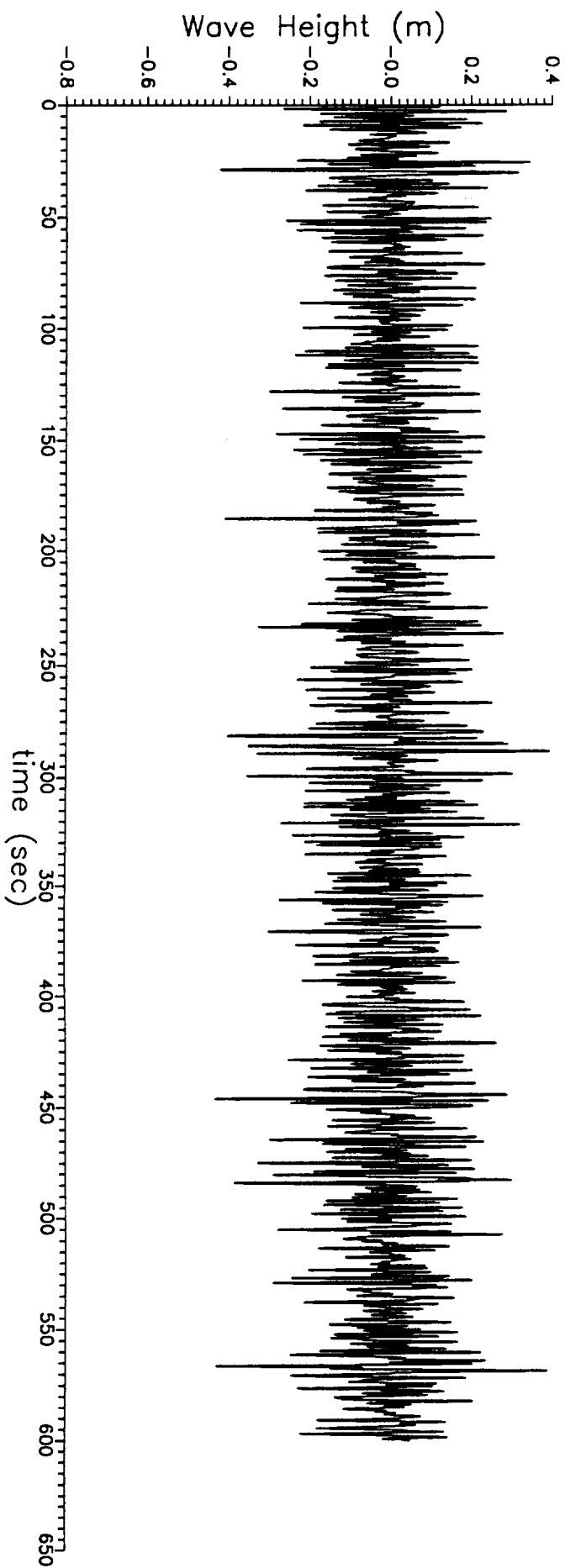
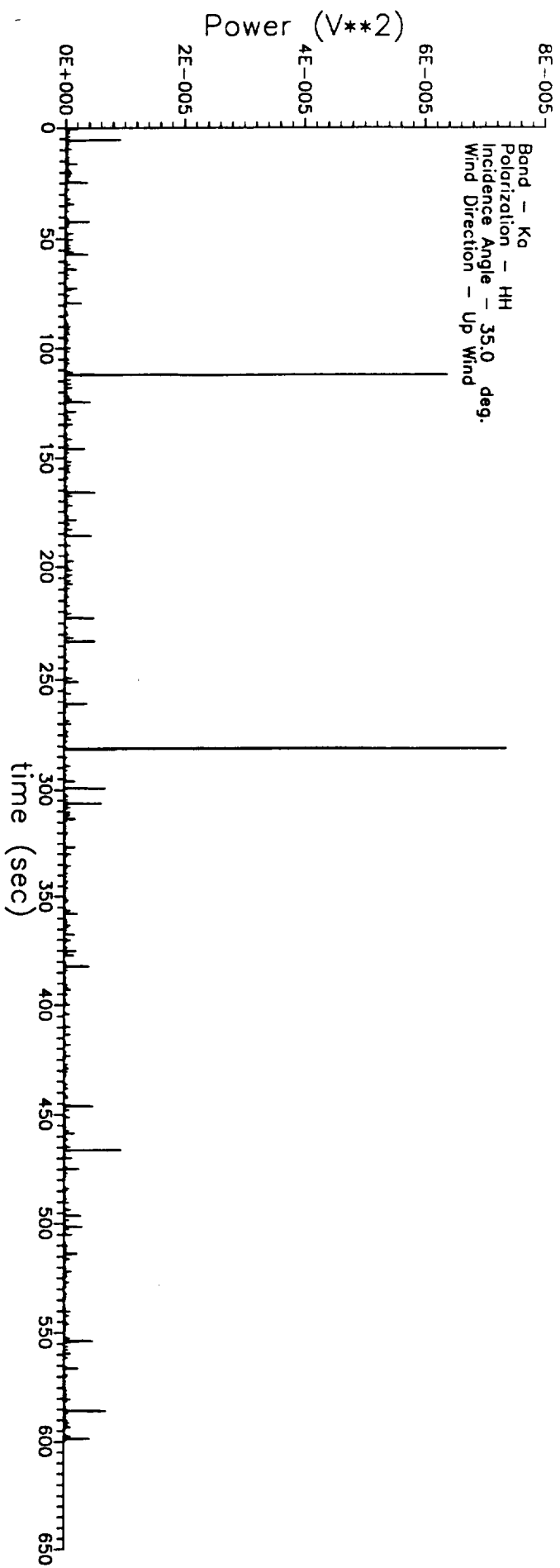


Run 16, 19:15, Aug 7, 1989



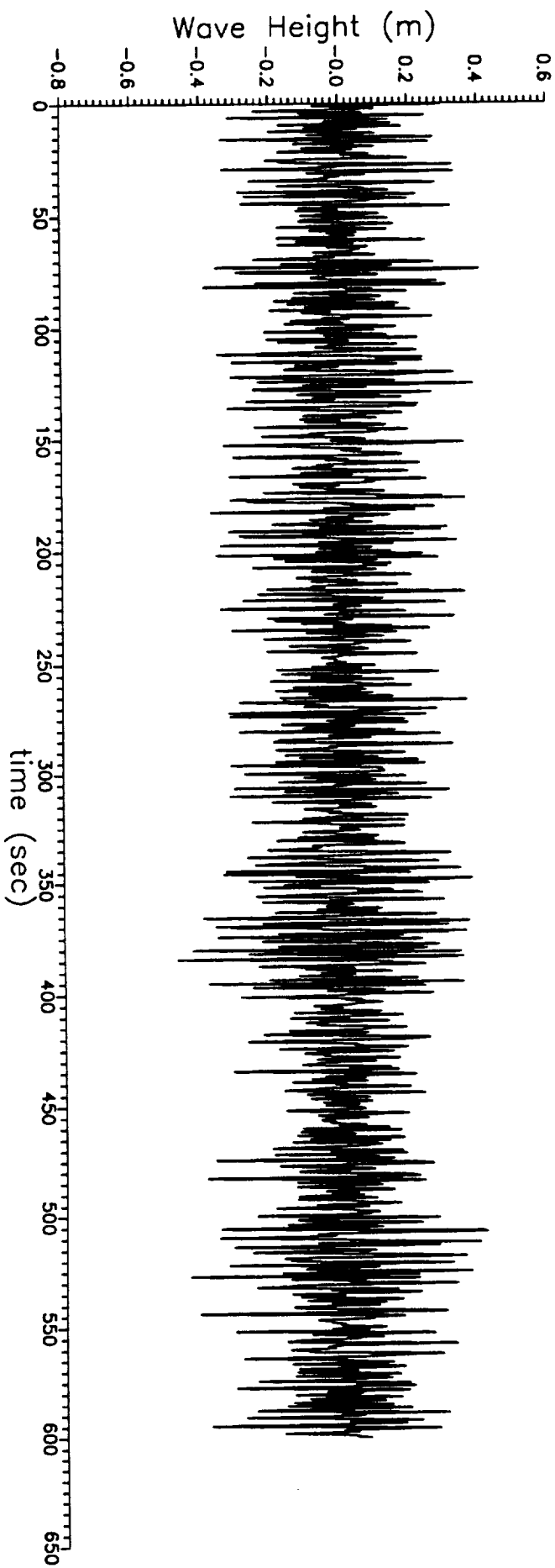
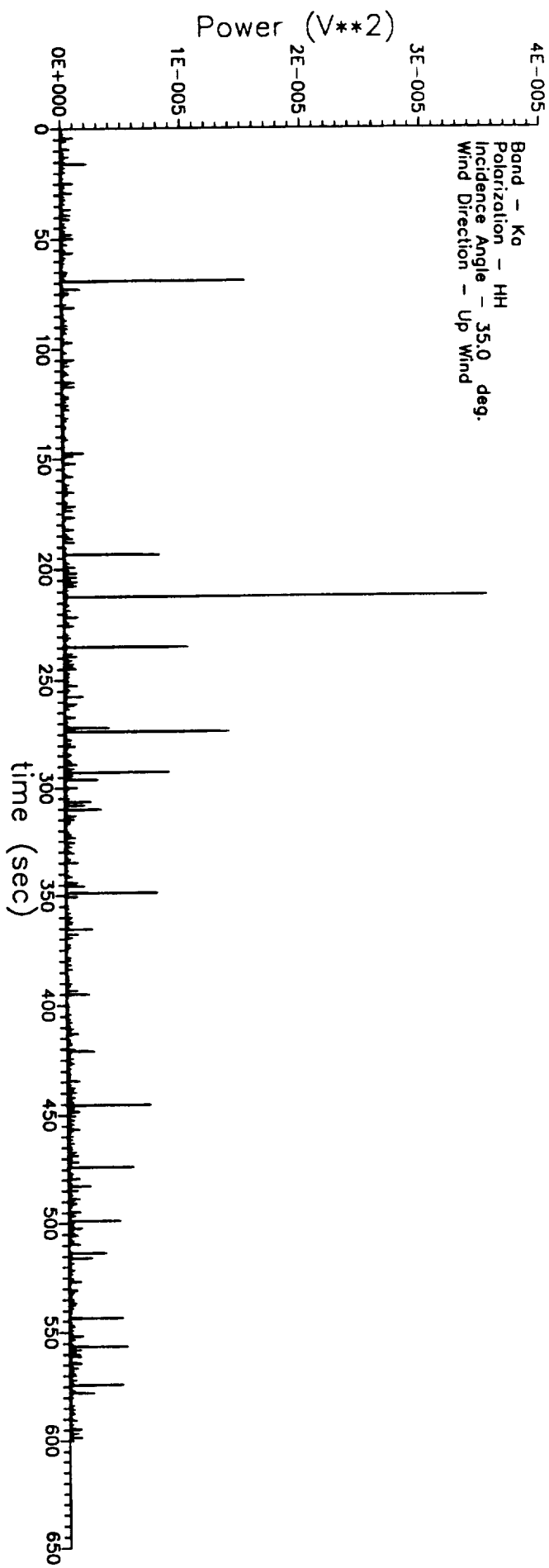
A-3. Ka Band

Run 8 , 19:45, July 16, 1990



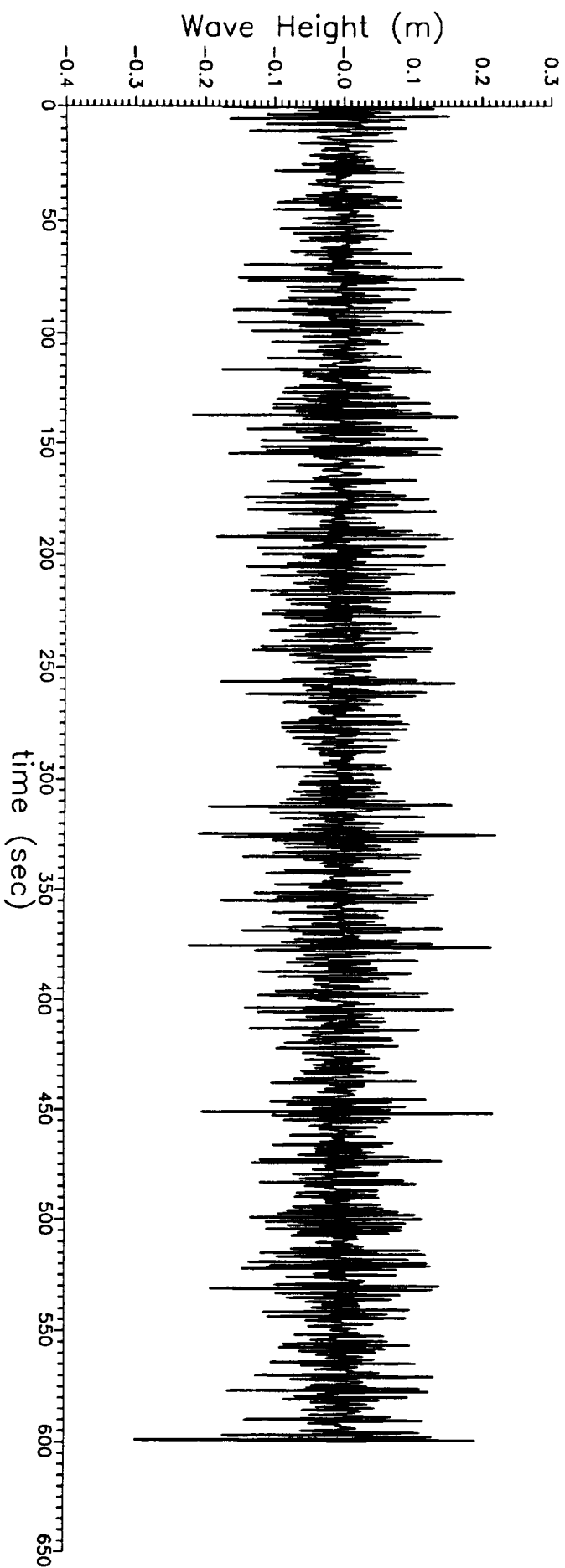
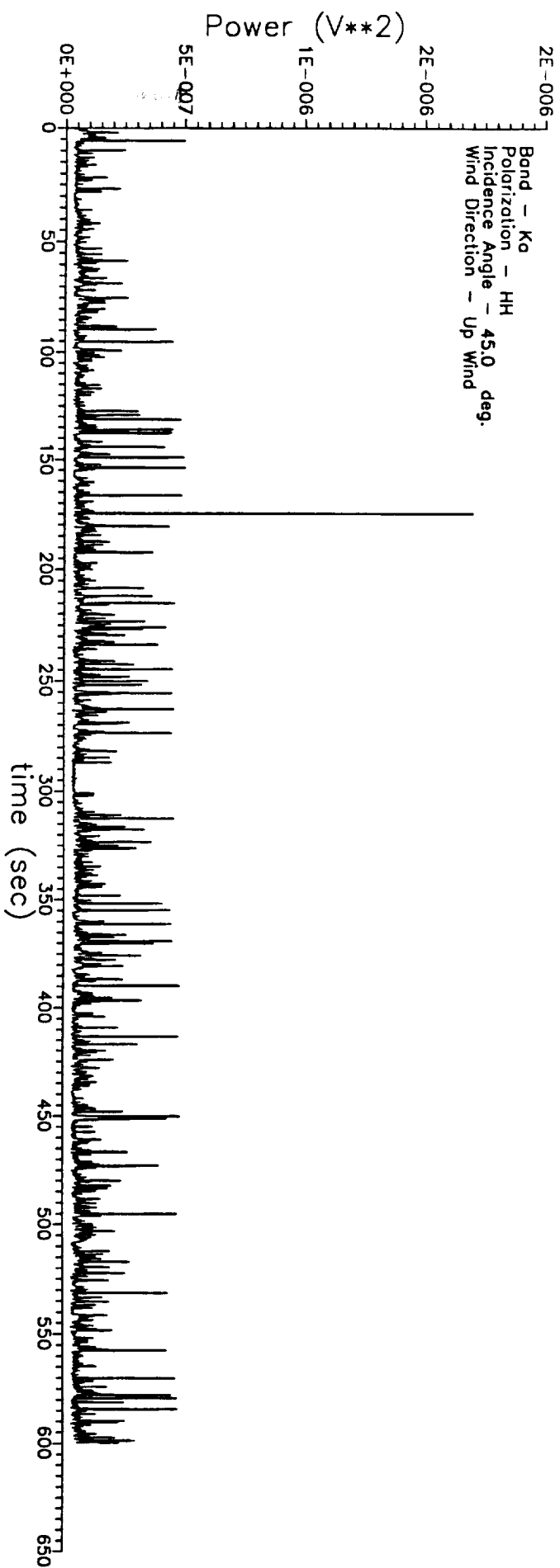
Run 10 , 20:28, July 16, 1990

Band - K₀
Polarization - HH
Incidence Angle - 35.0 deg.
Wind Direction - Up Wind



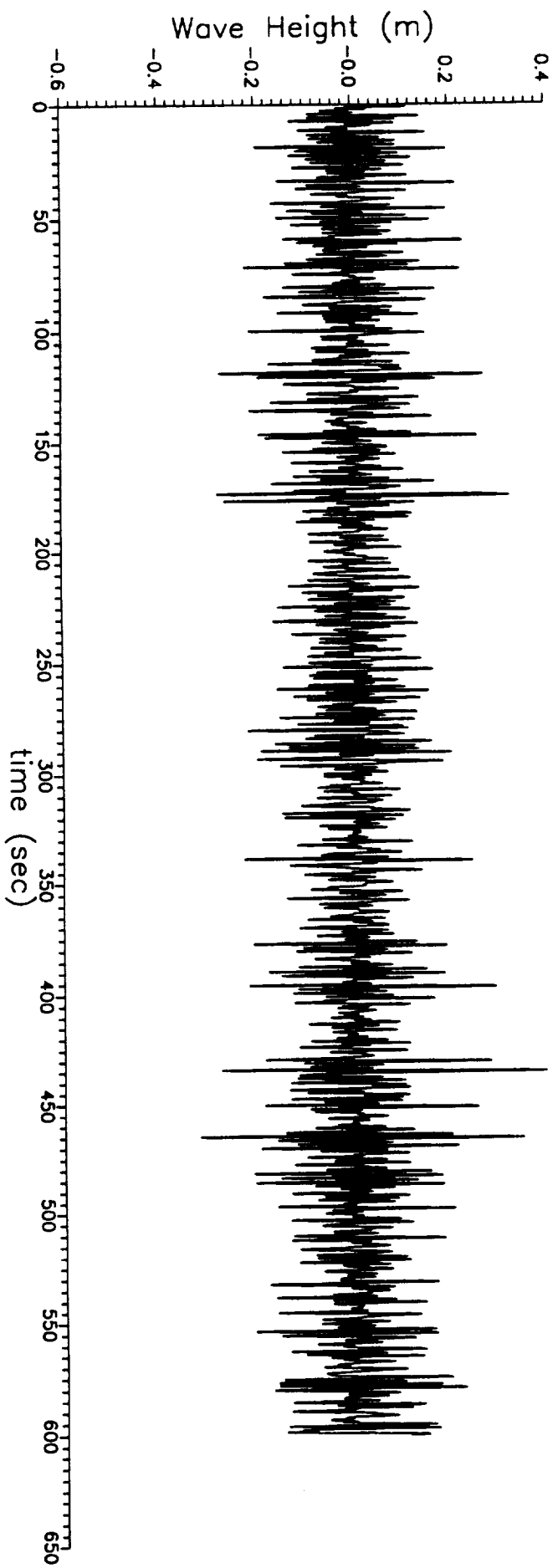
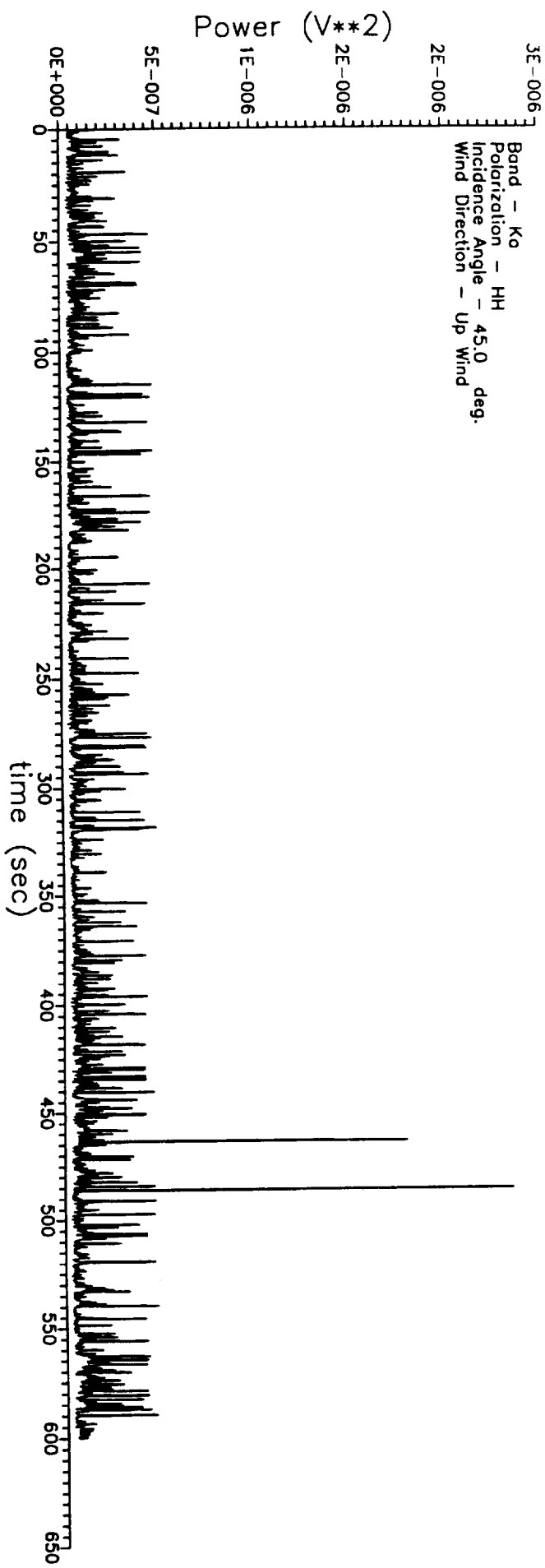
Run 5 , 19:08, July 17, 1990

Band - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind



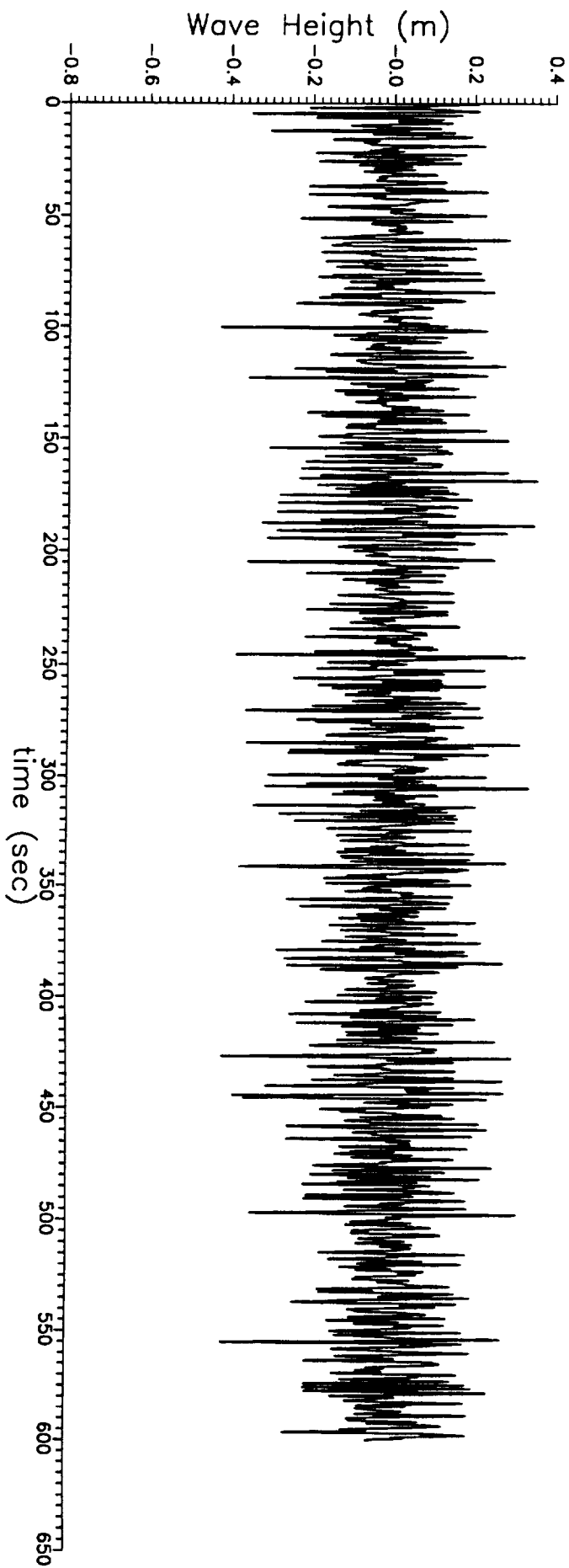
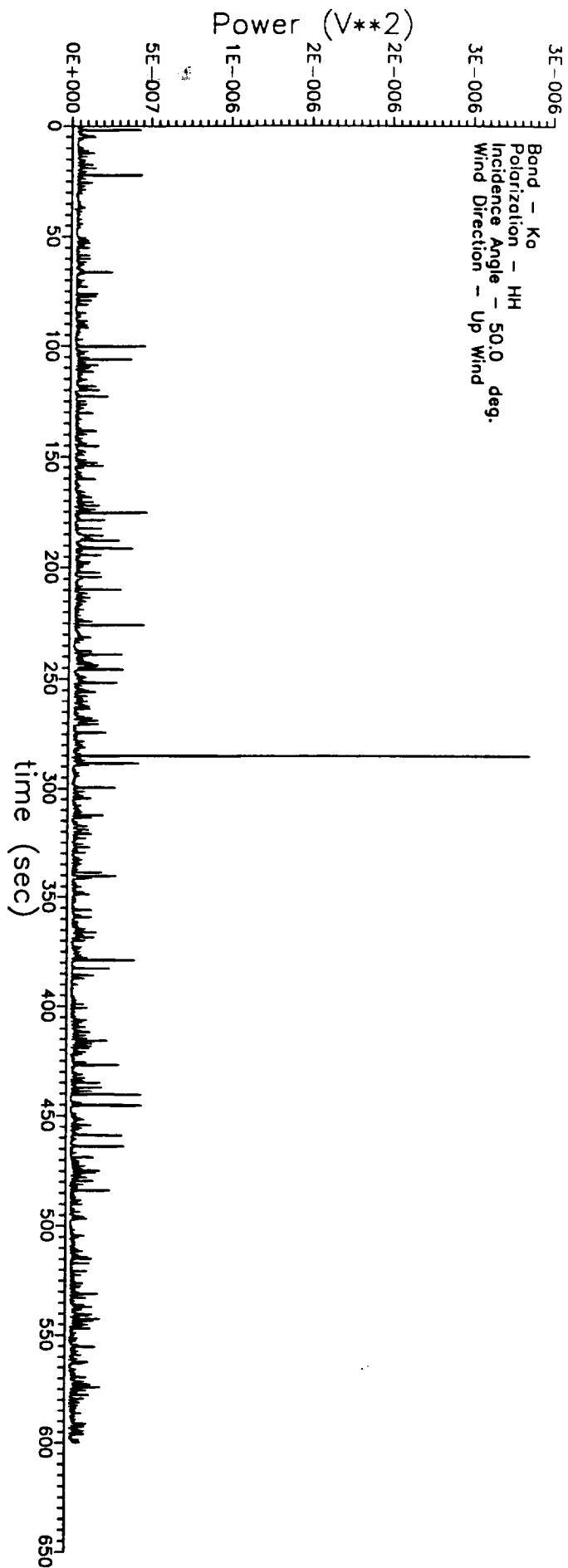
Run 6 , 19:34, July 17, 1990

Band - K₀
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

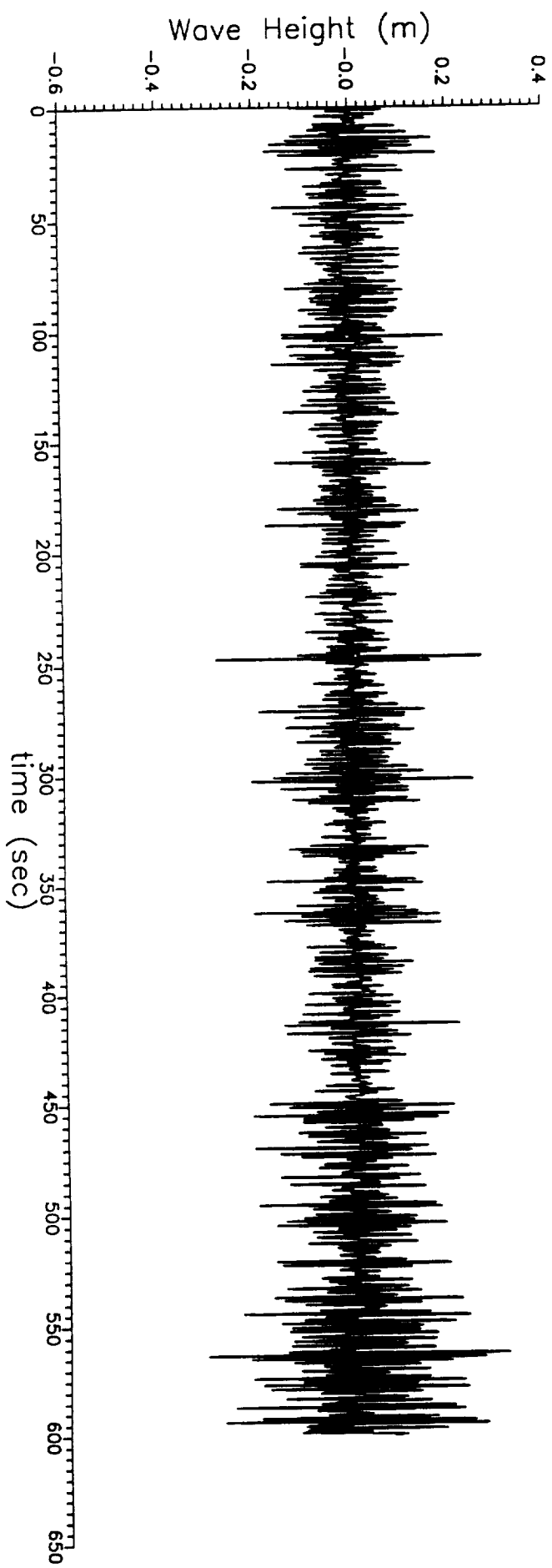
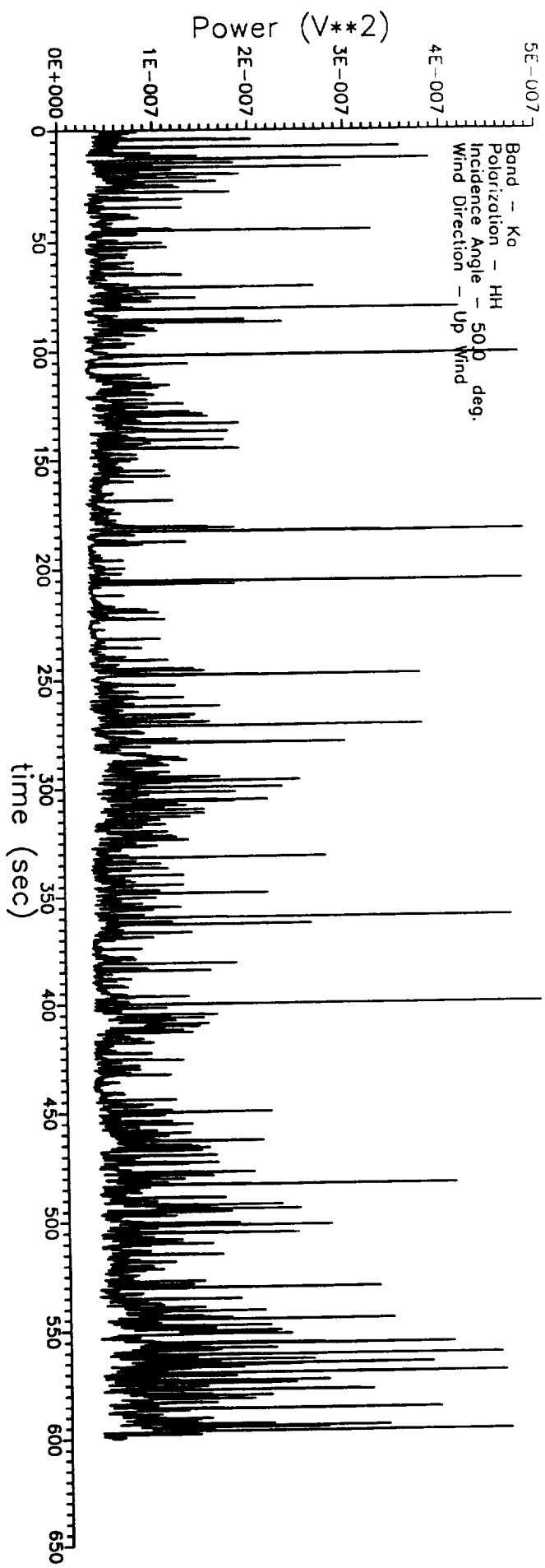


Run 7 , 19:49, July 17, 1990

Band - K_o
Polarization - HH
Incidence Angle - 50.0 deg.
Wind Direction - Up Wind

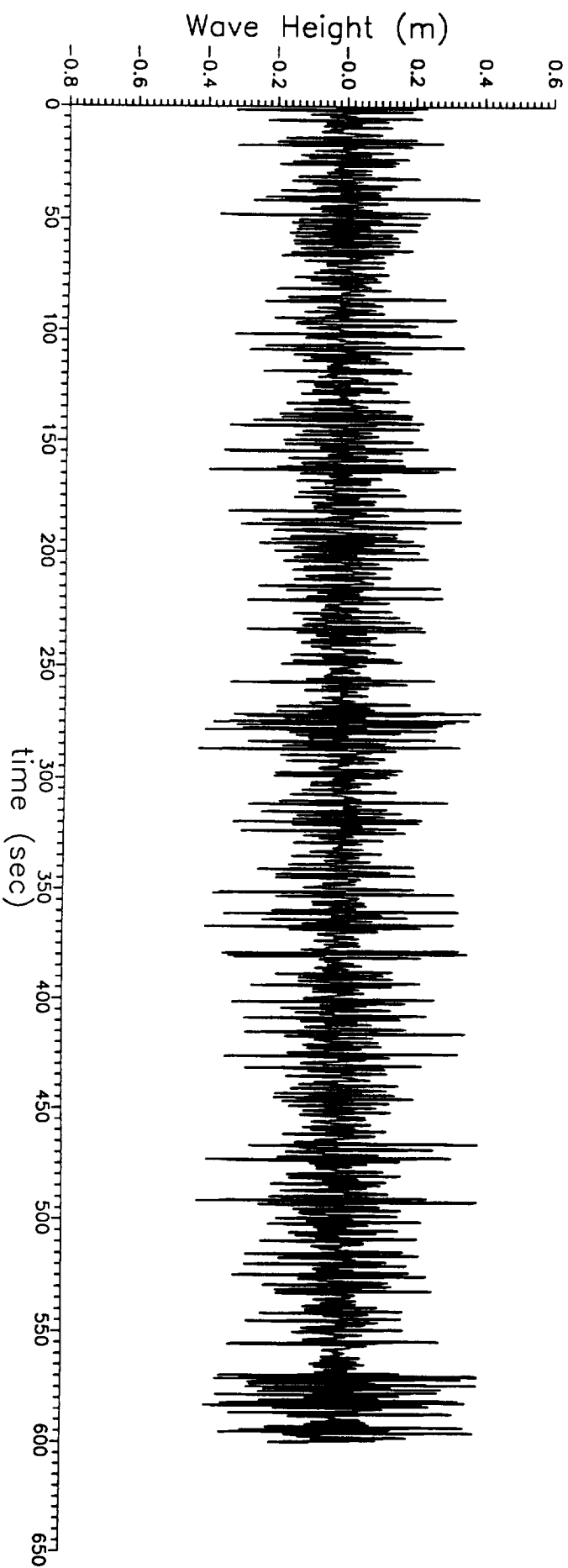
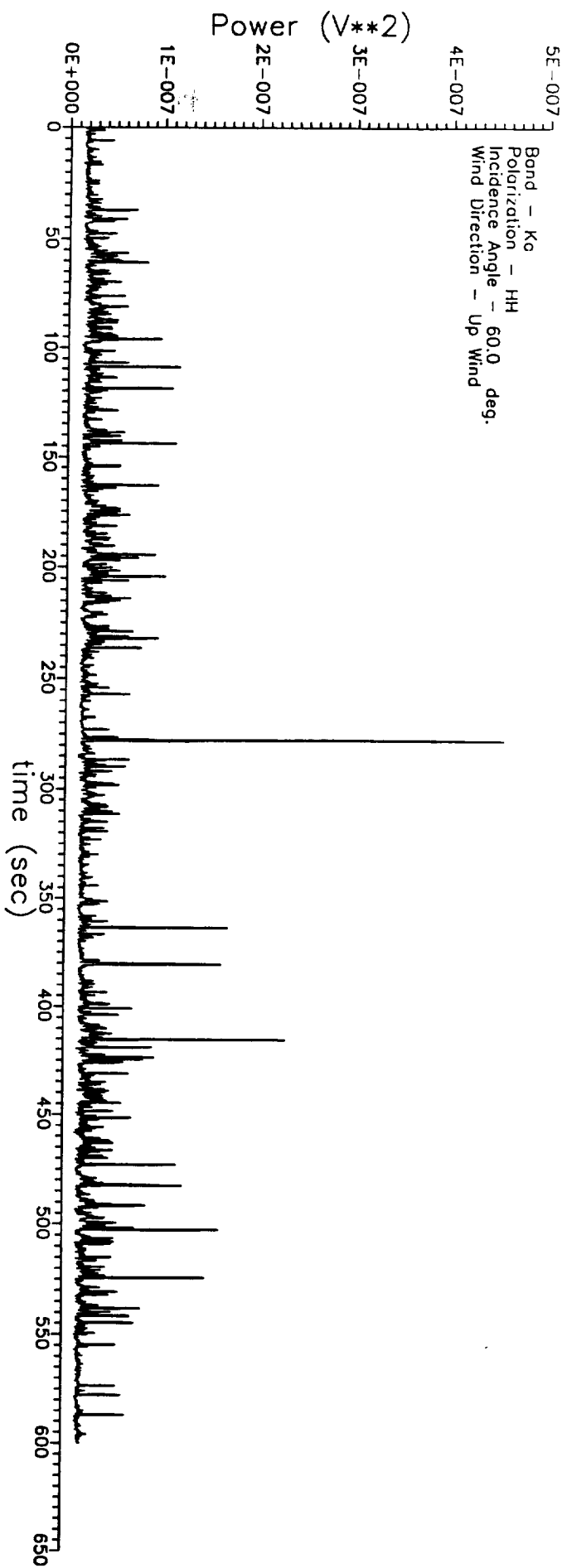


Run 8 , 20:03, July 17, 1990

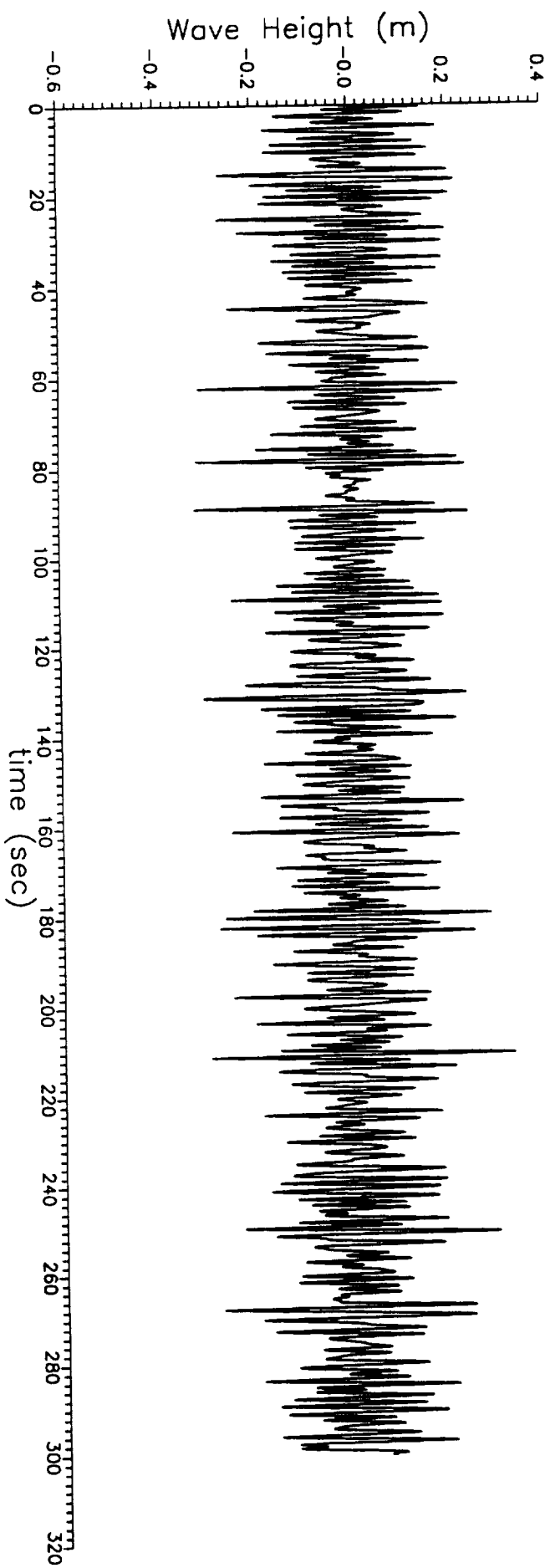
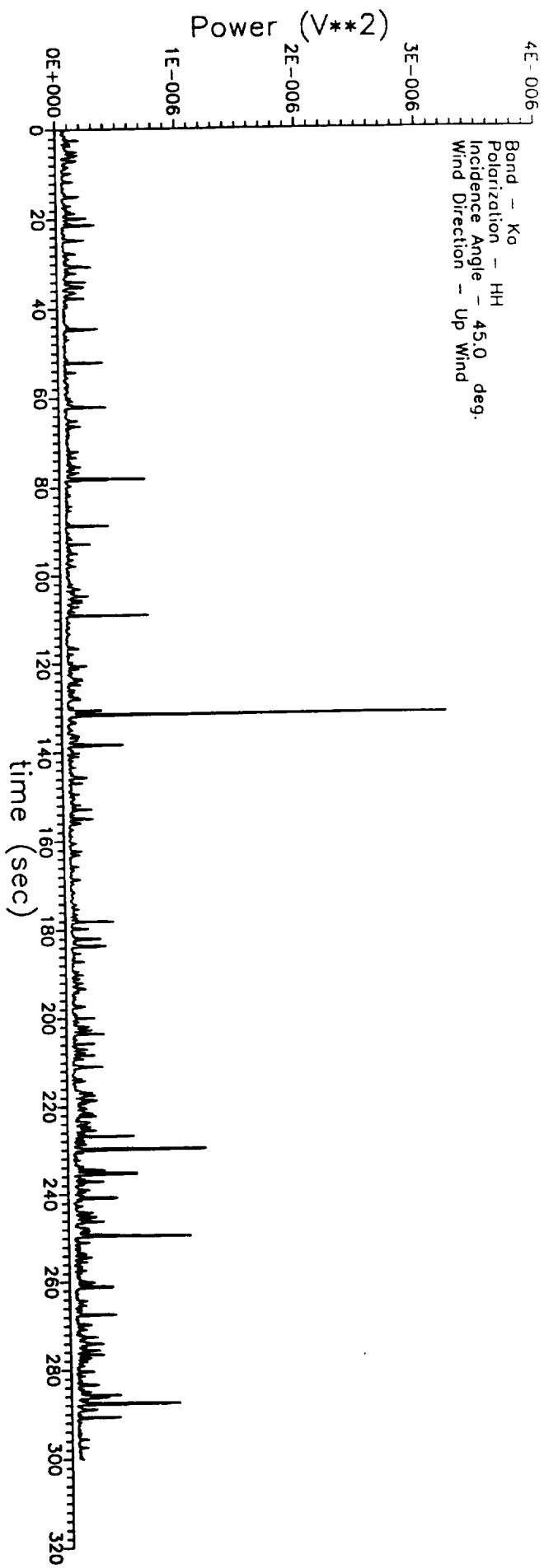


Run 10 , 20:58, July 17, 1990

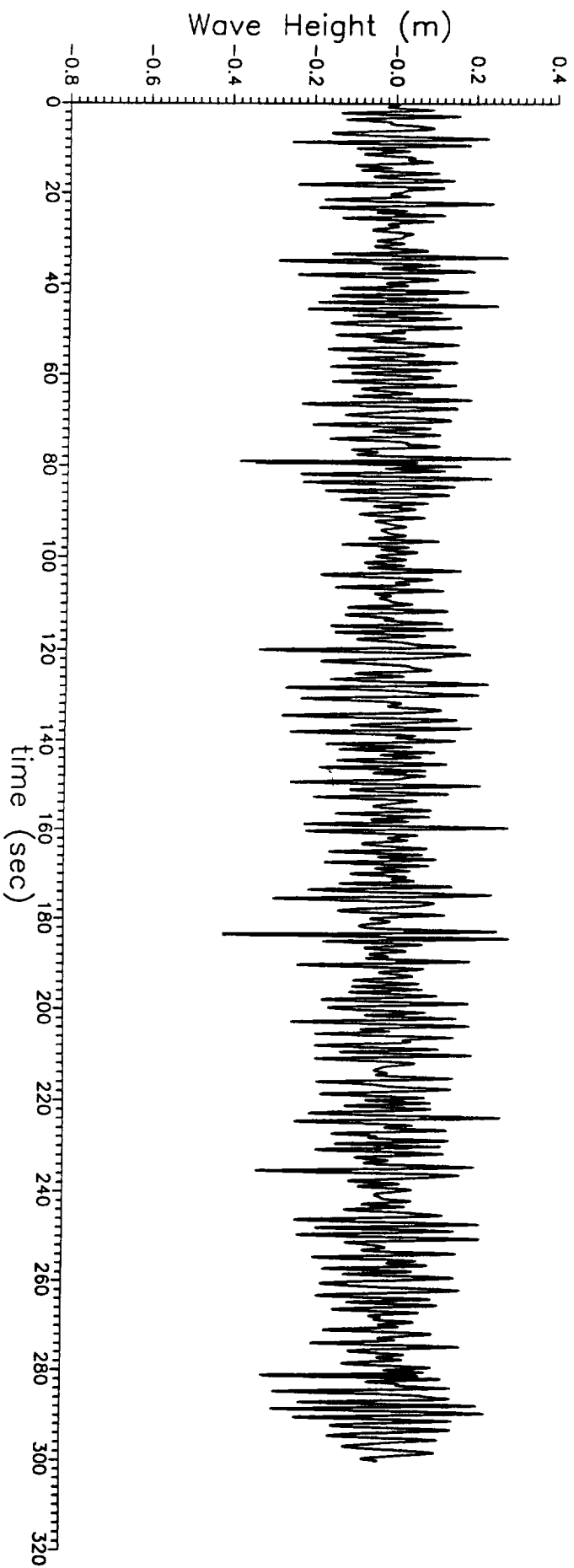
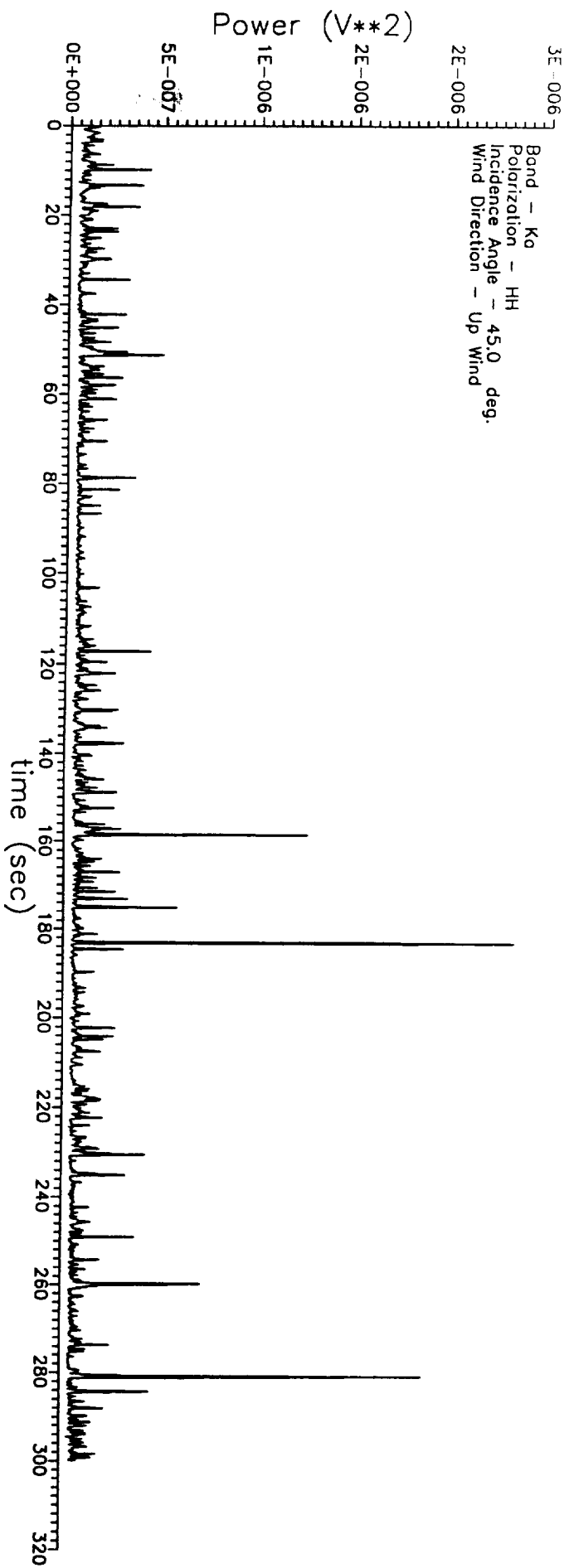
Bond - Ke
Polarization - HH
Incidence Angle - 60.0 deg.
Wind Direction - Up Wind



Run 17 , 18:56, July 18, 1990

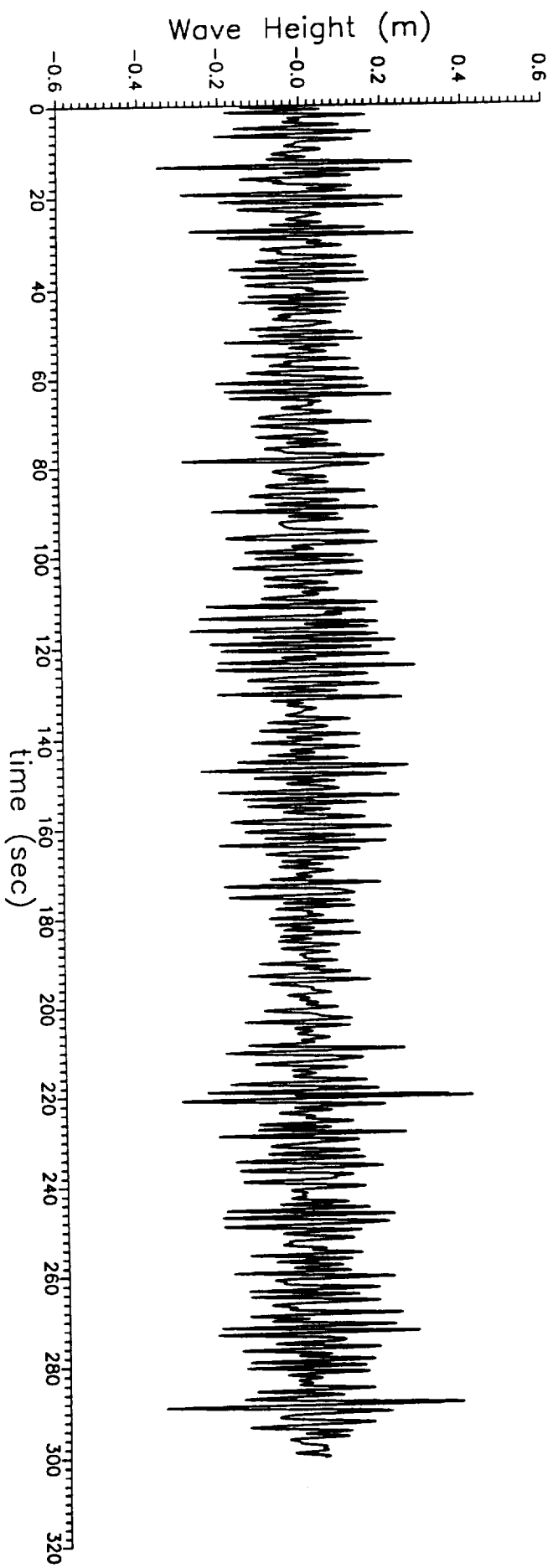
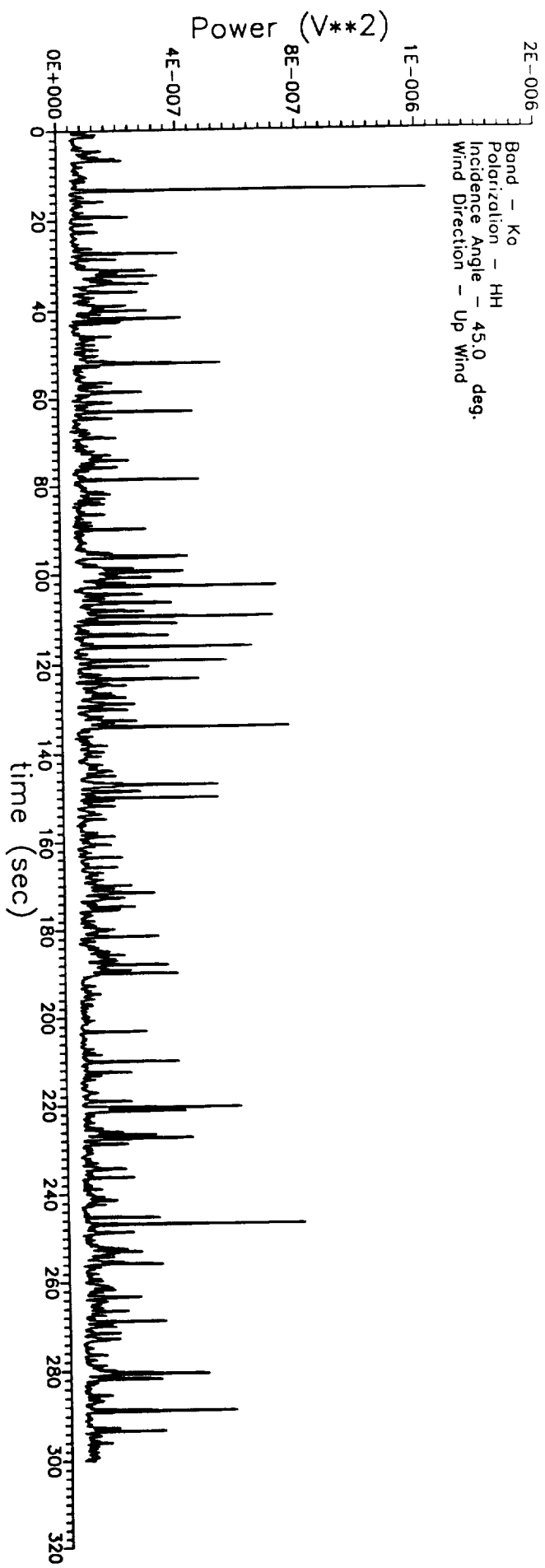


Run 18 , 19:04, July 18, 1990



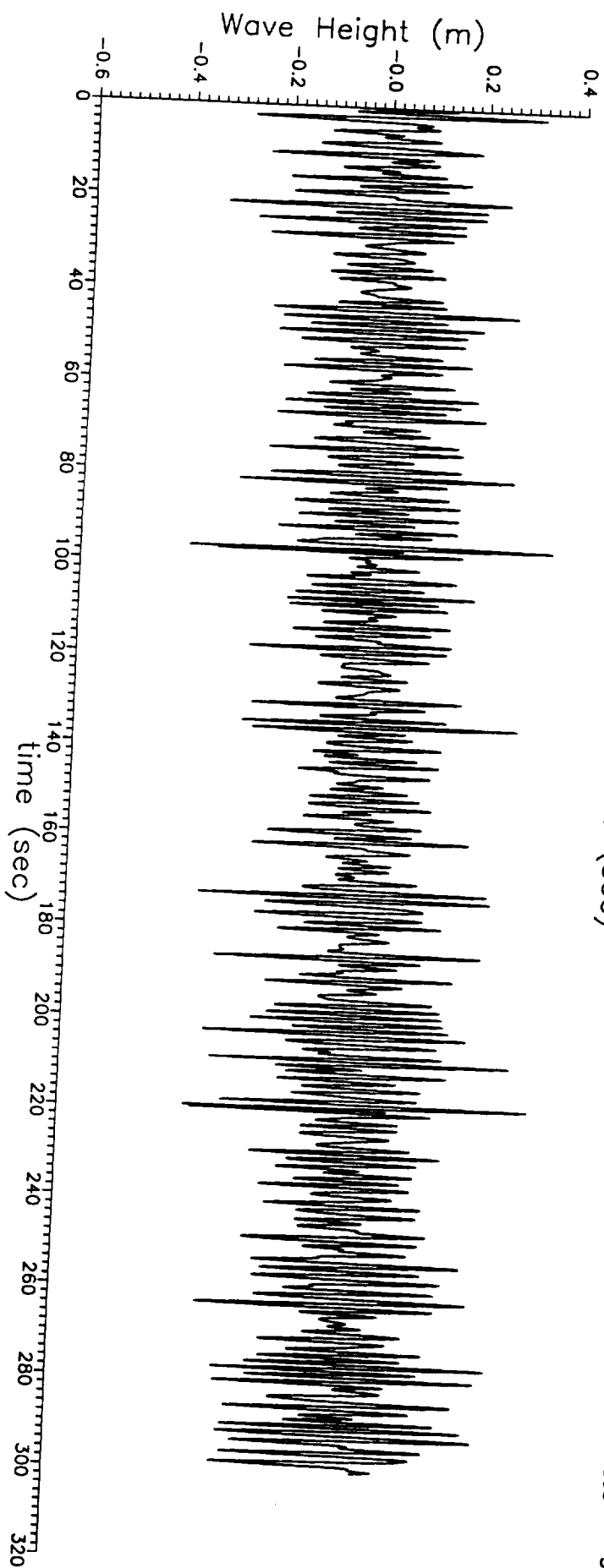
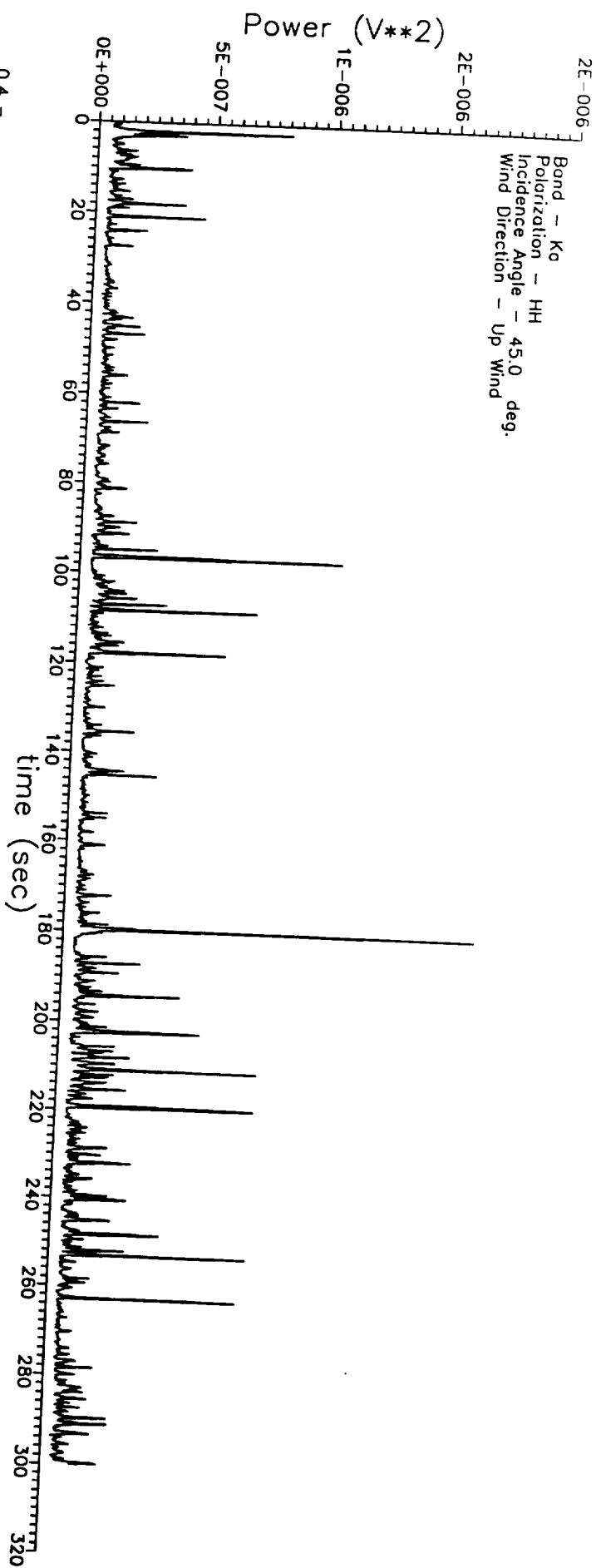
Run 19 , 19:11, July 18, 1990

Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

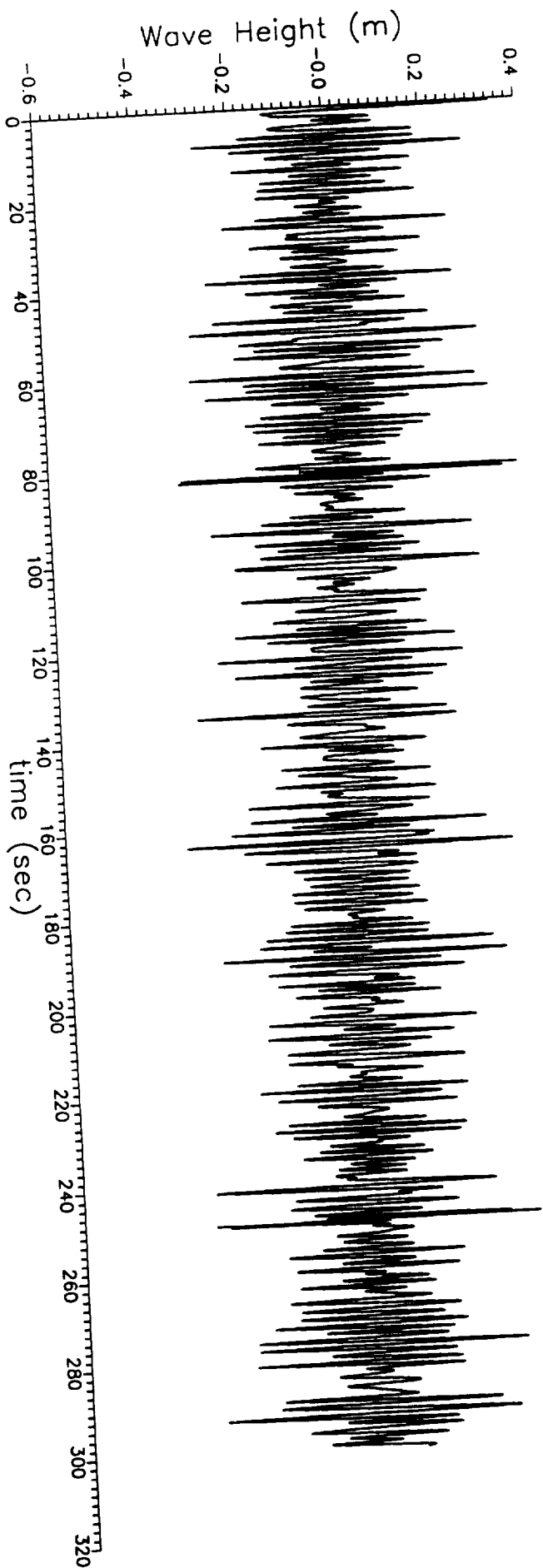
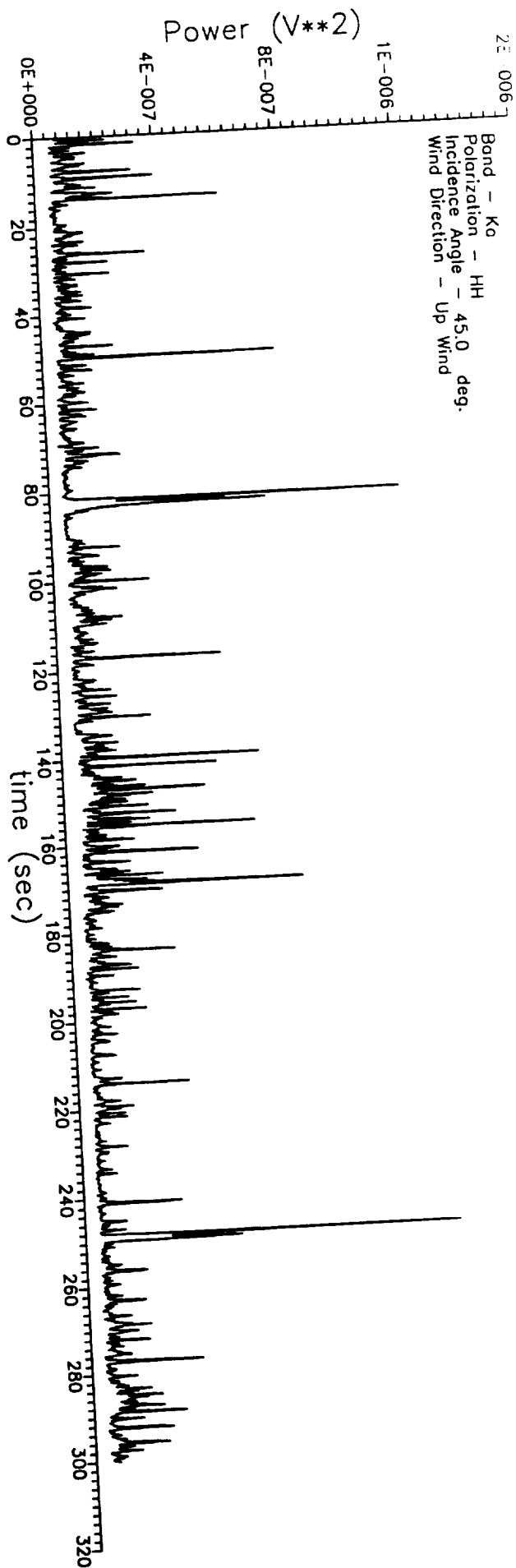


Run 20 , 19:17, July 18, 1990

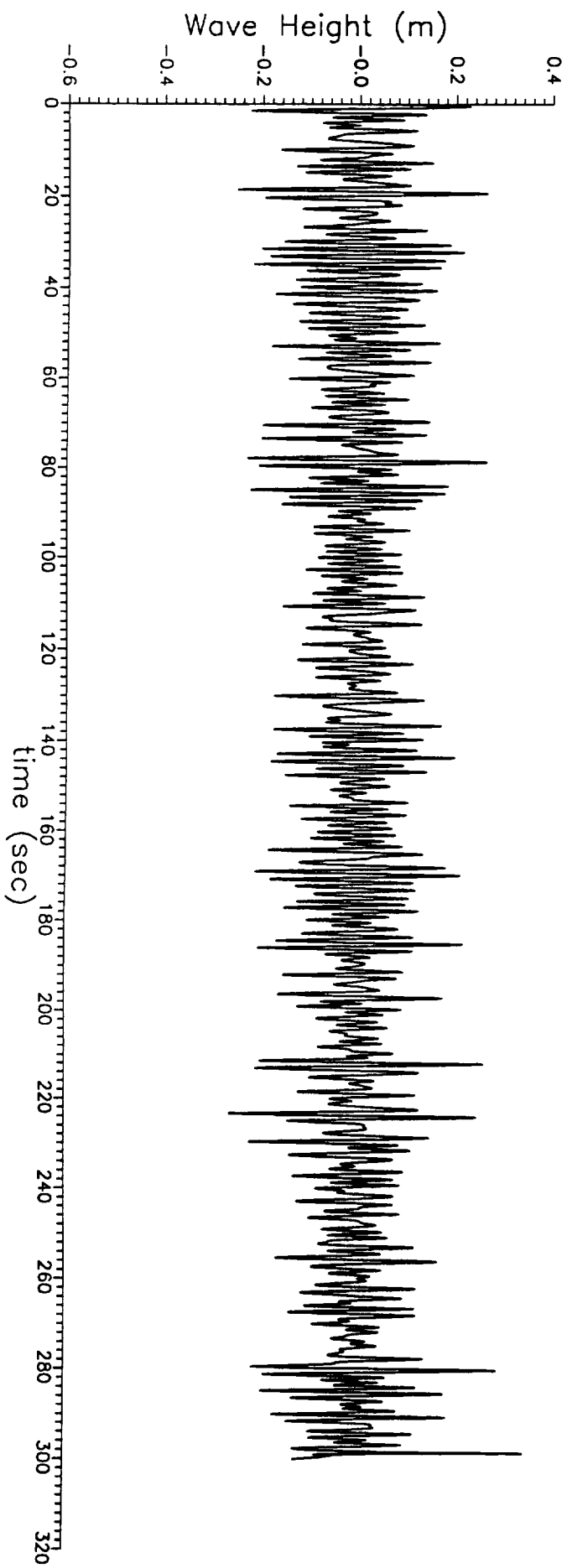
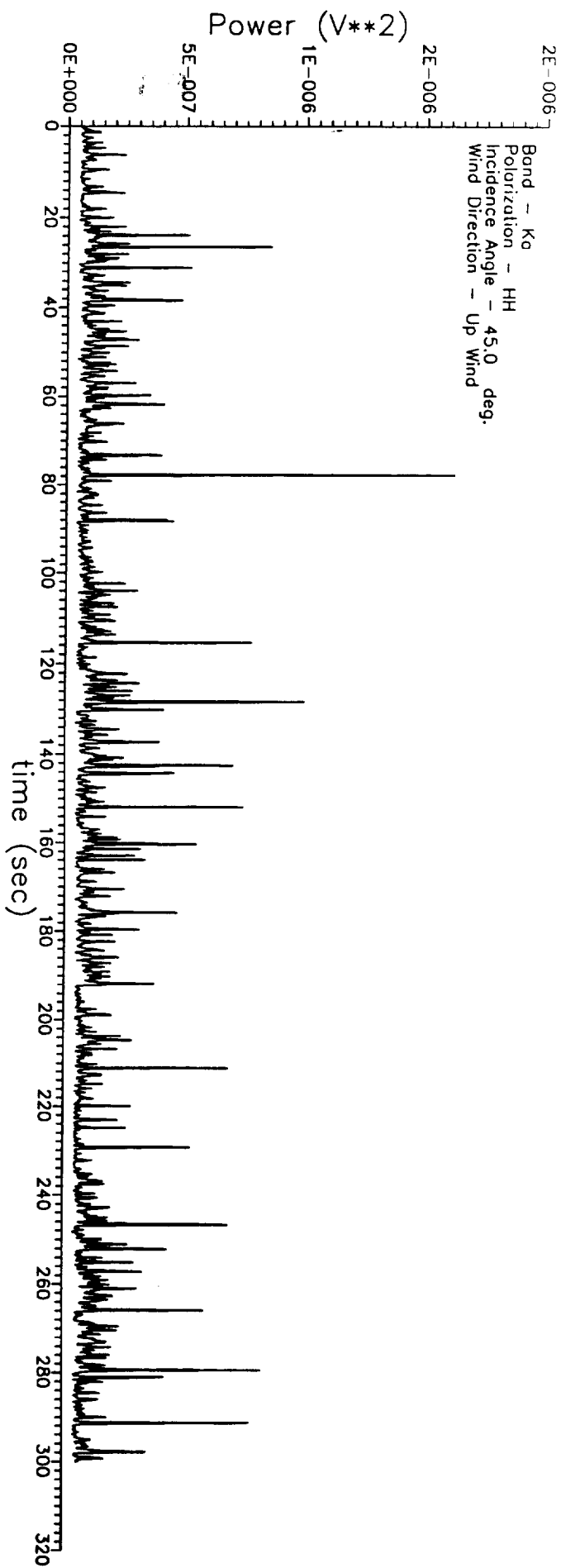
Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind



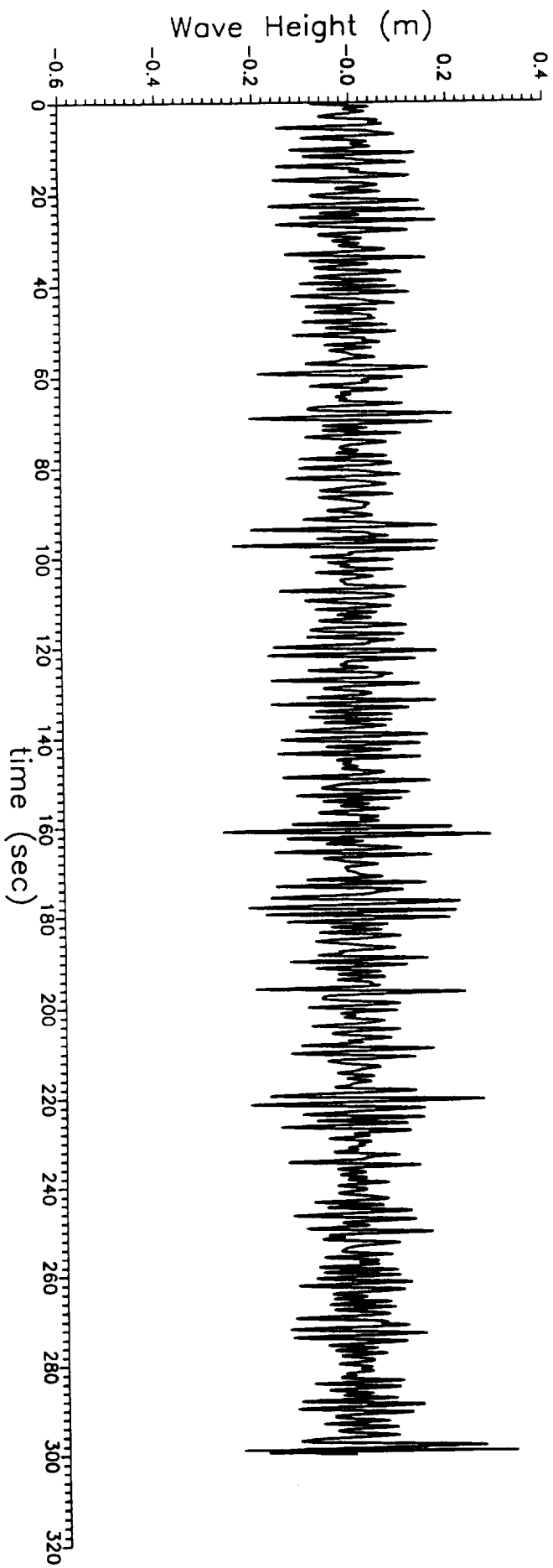
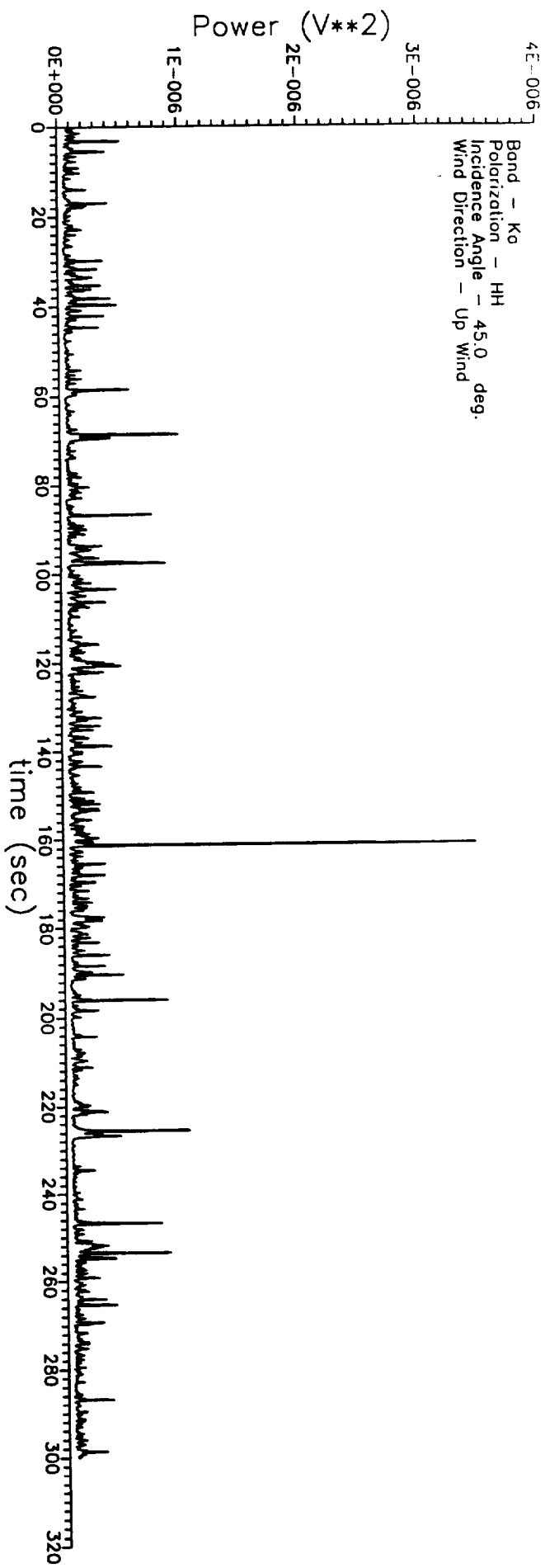
Run 21 , 19:23, July 18, 1990

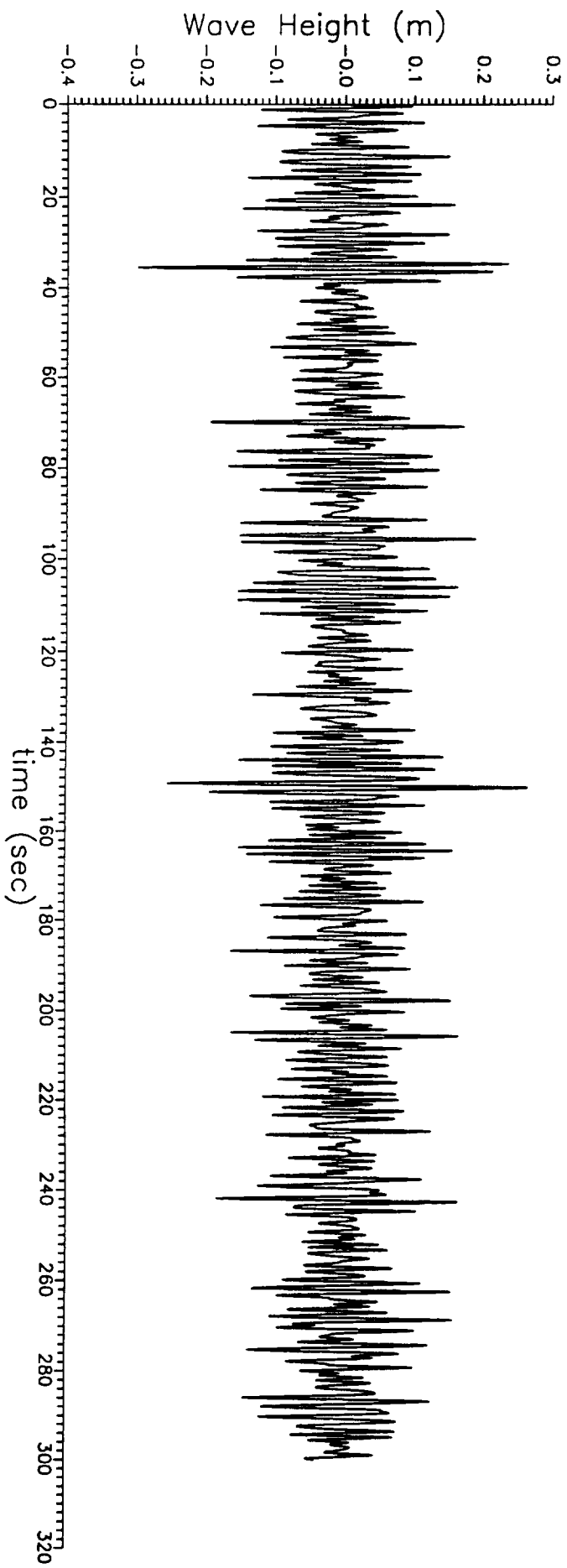
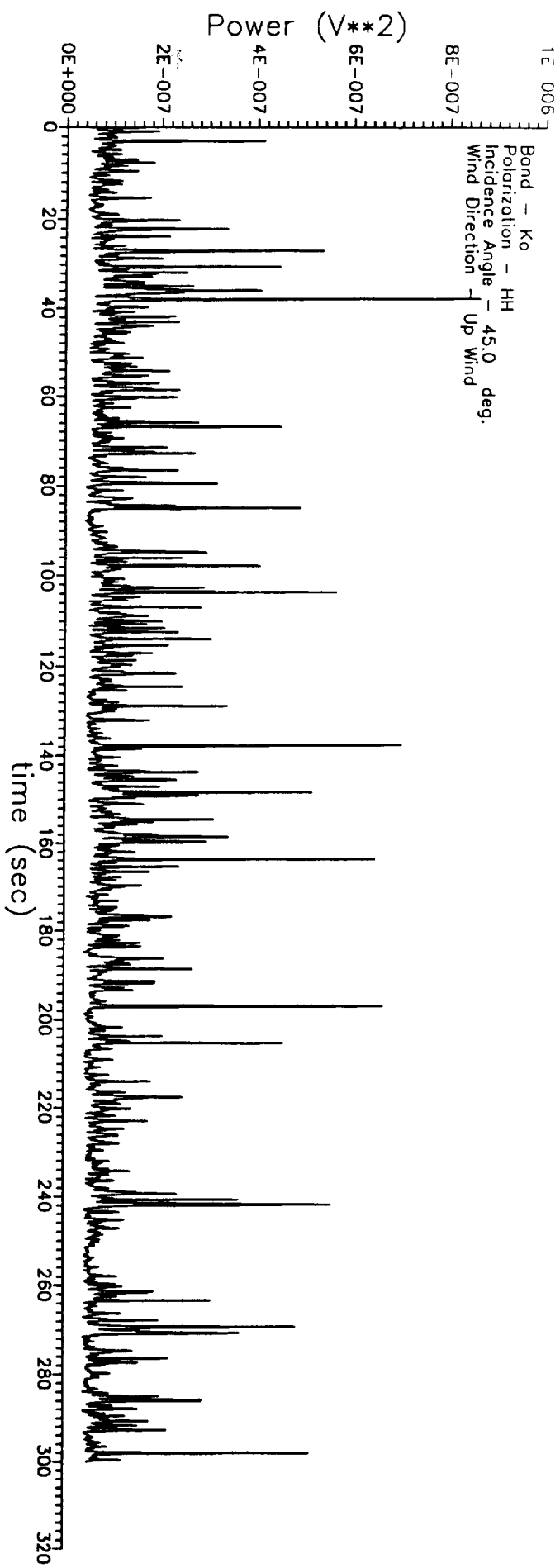


Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind



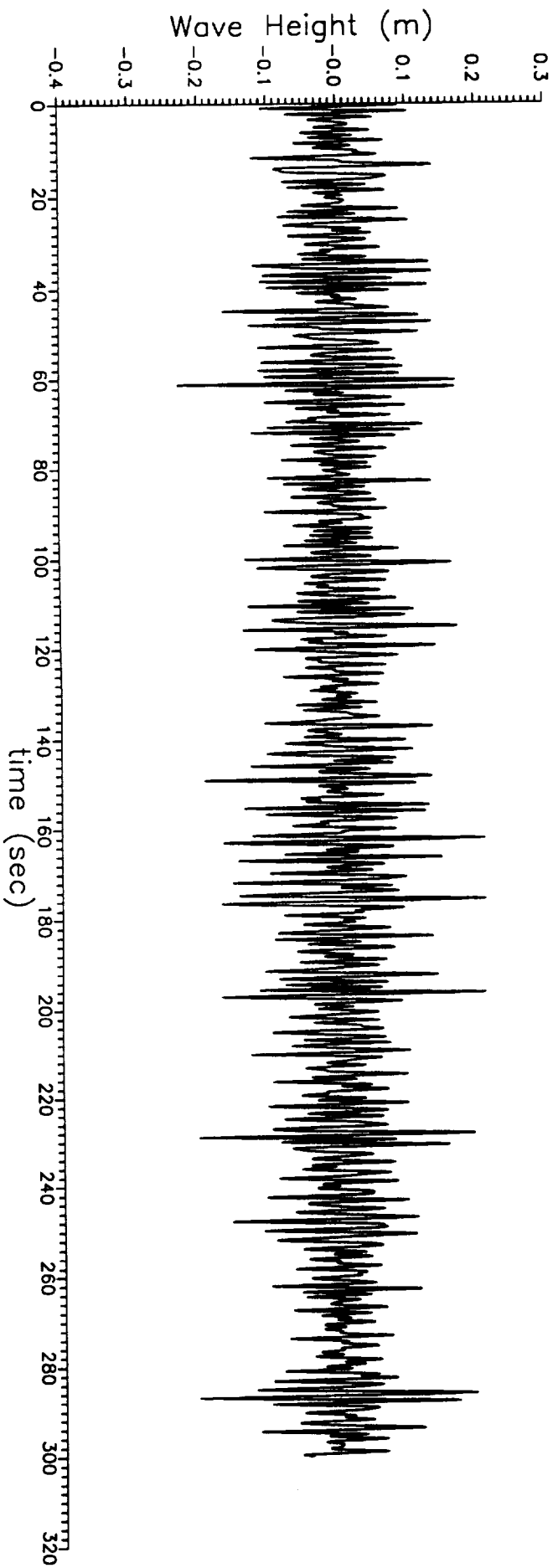
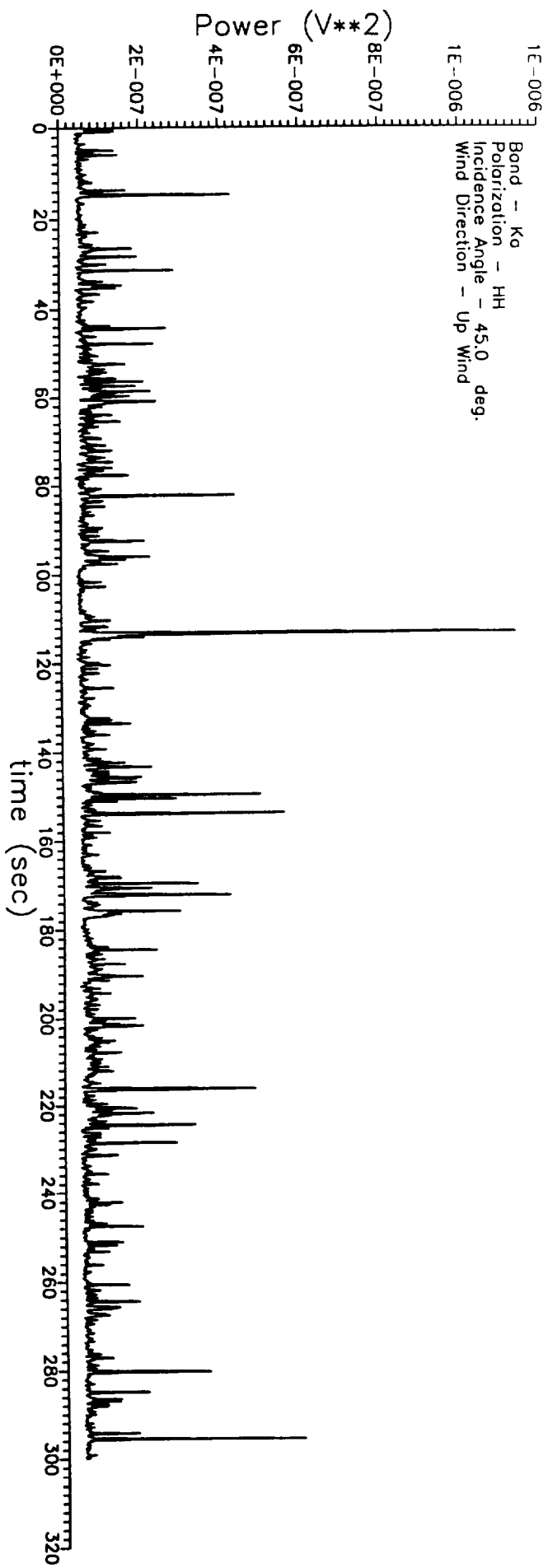
Run 23 , 19:47, July 18, 1990



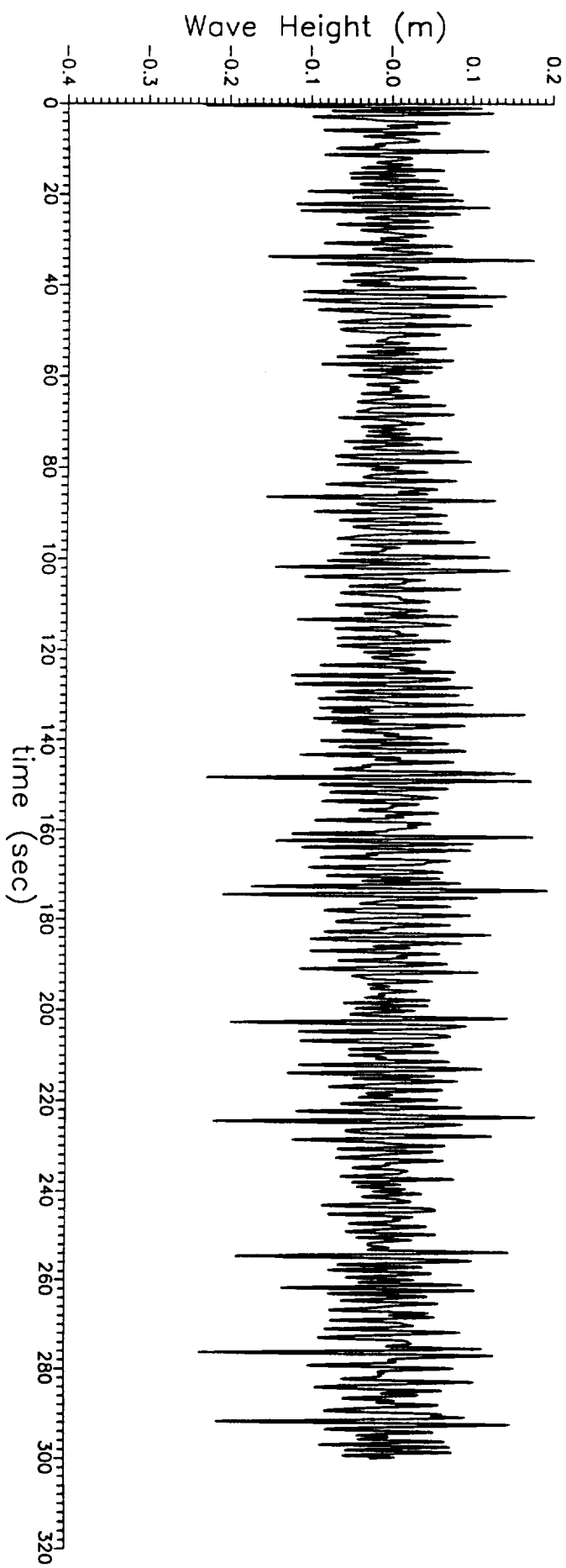
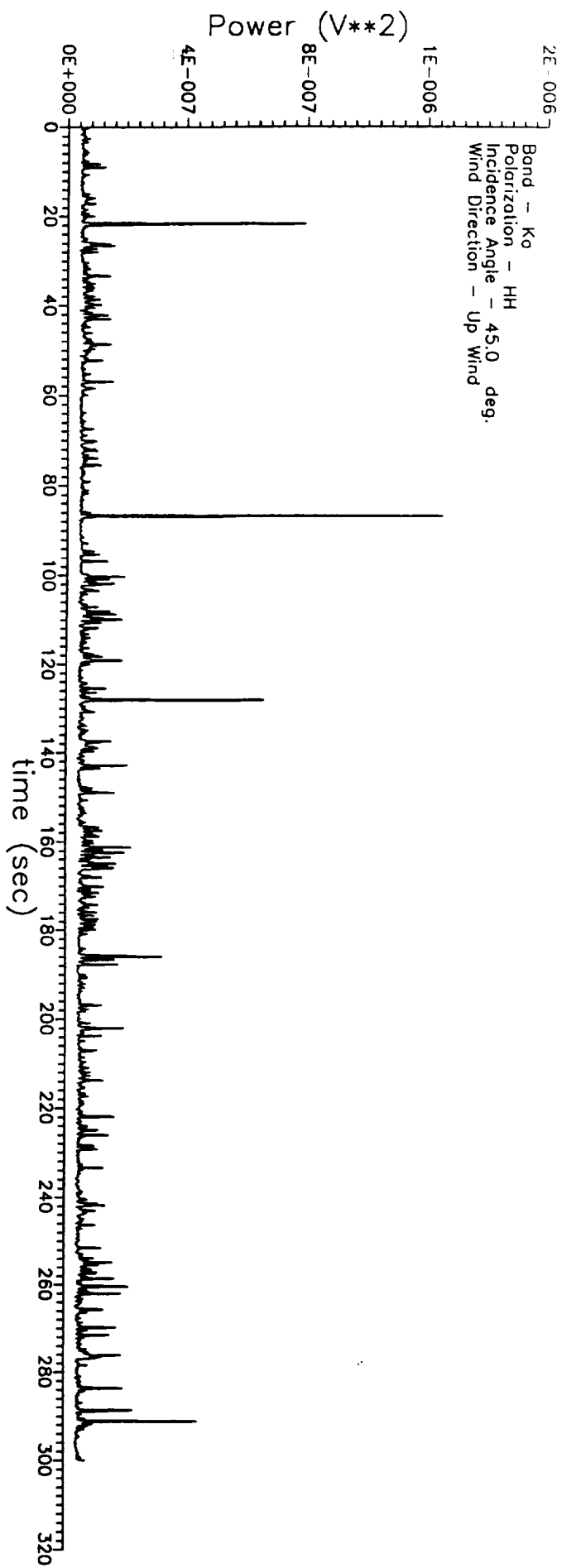


Run 25 , 20:02, July 18, 1990

Bond - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

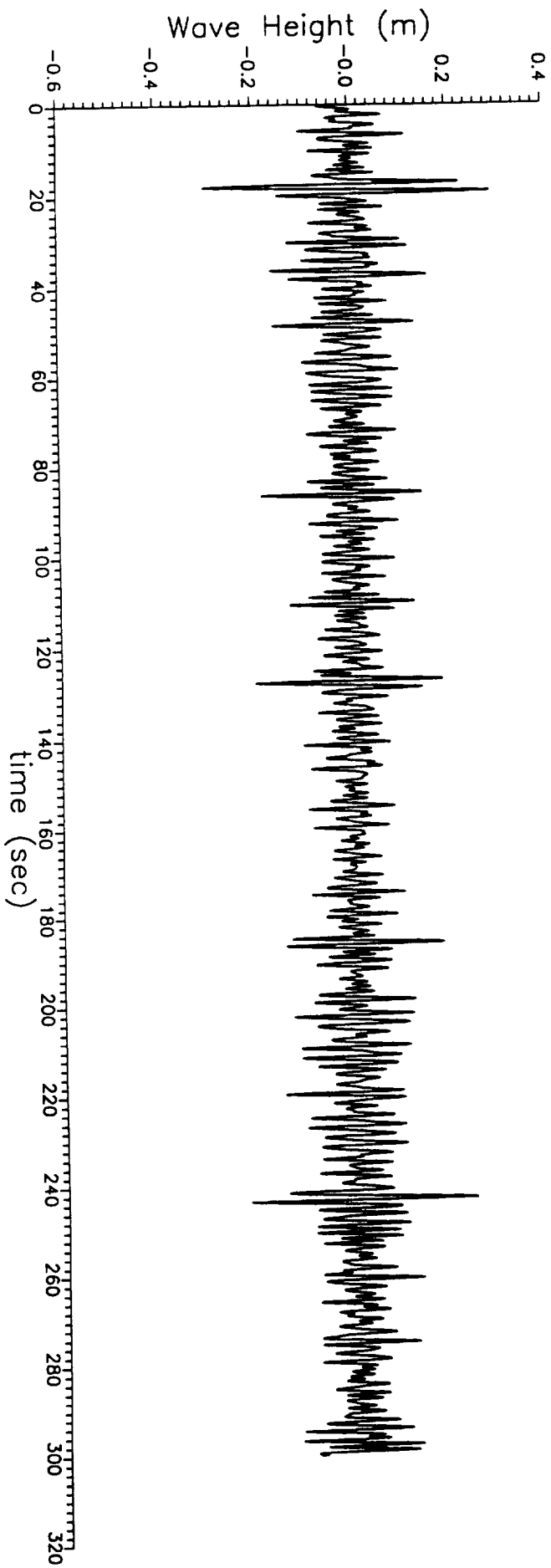
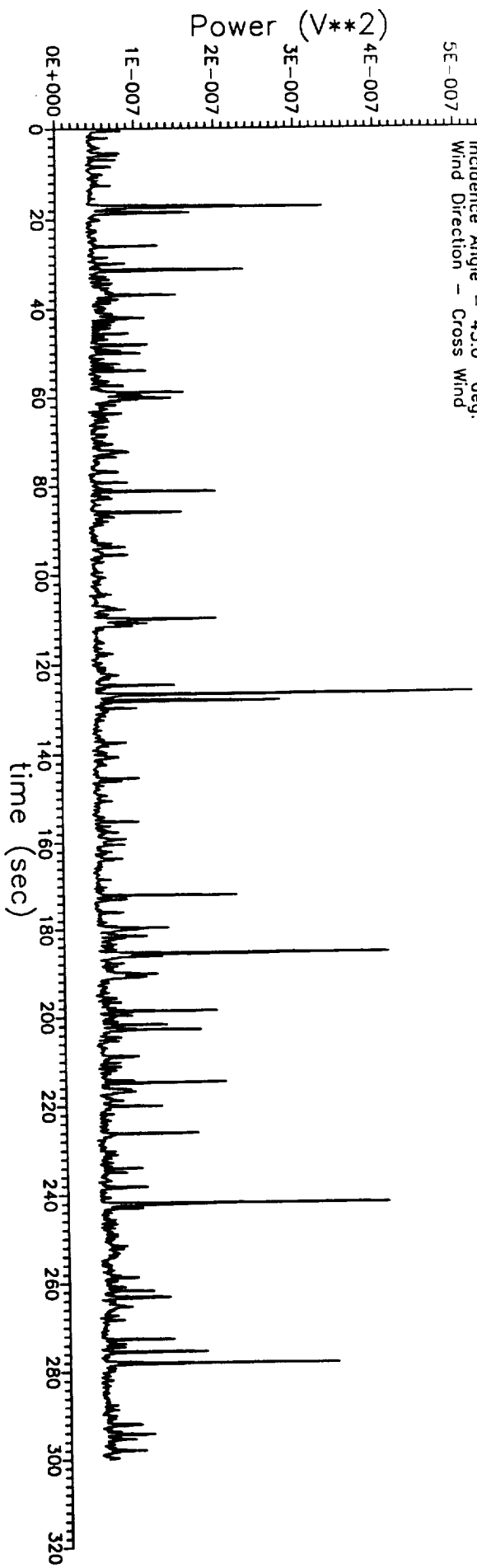


Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Up Wind

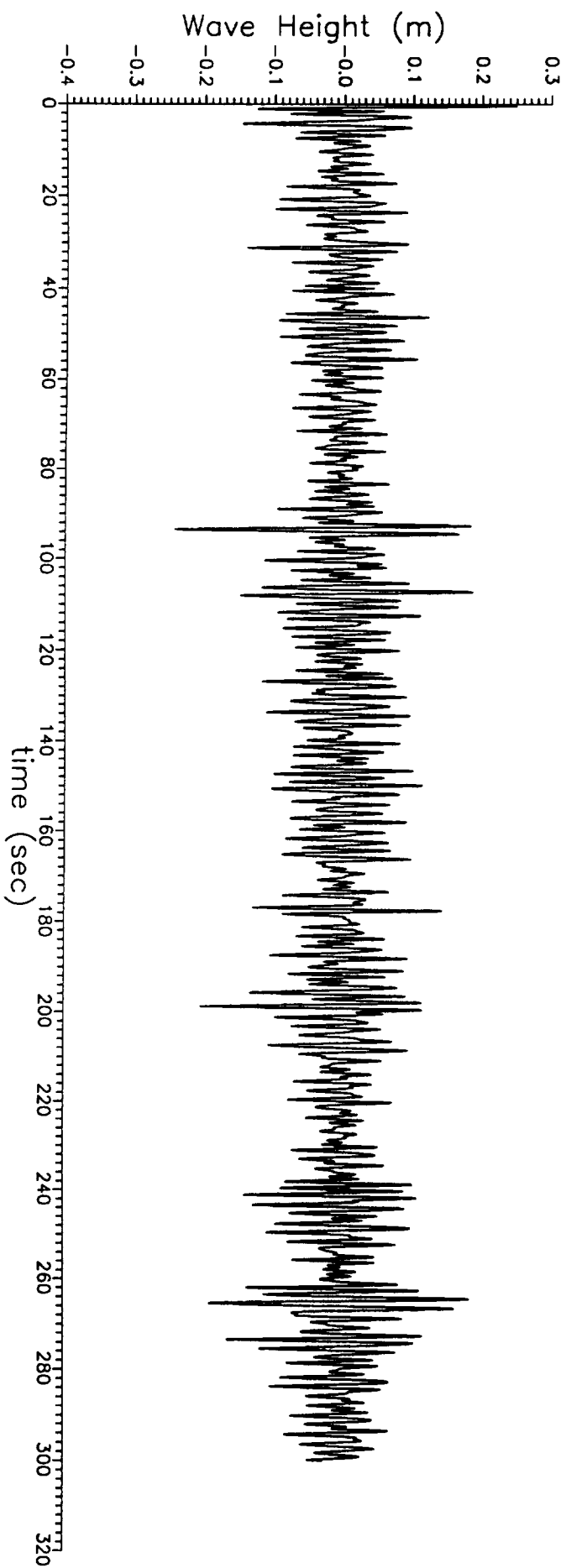
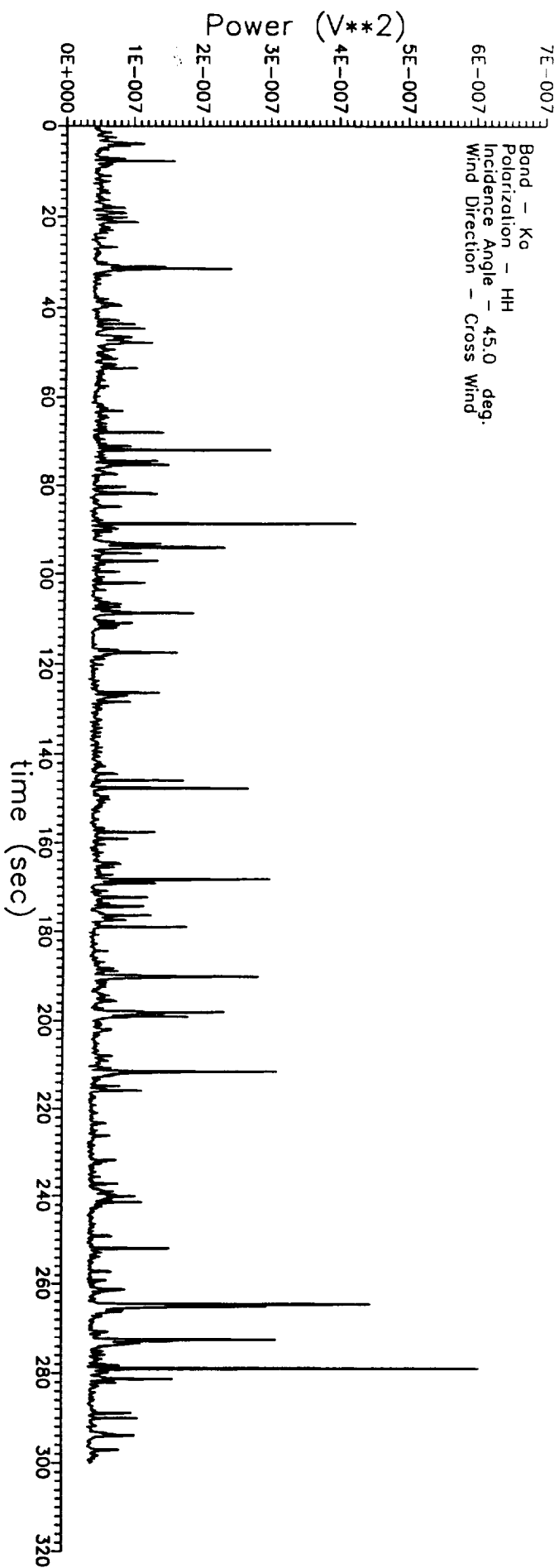


Run 27, 20:14, July 18, 1990

6E-007
Bond - Ka
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind

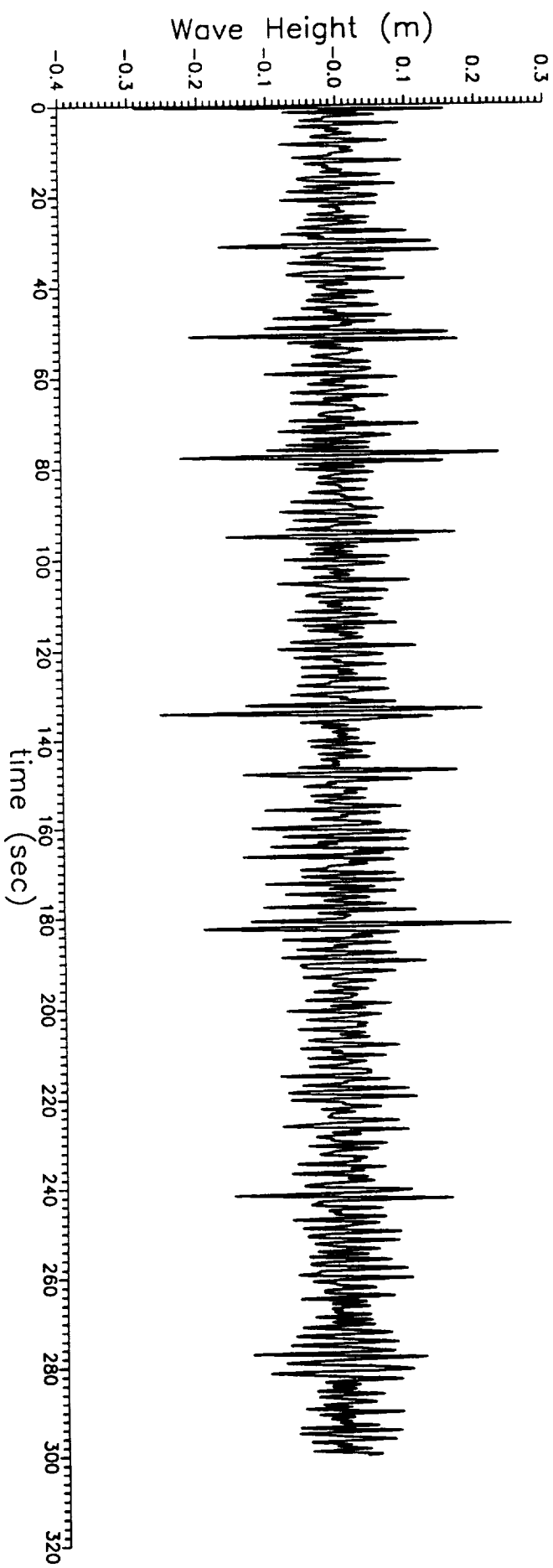
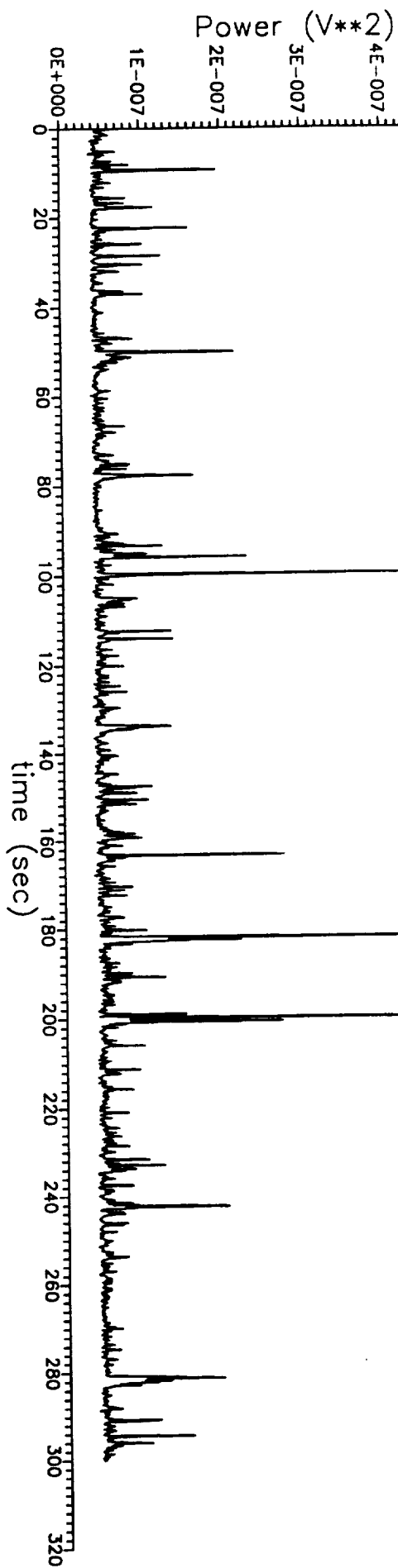


Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind

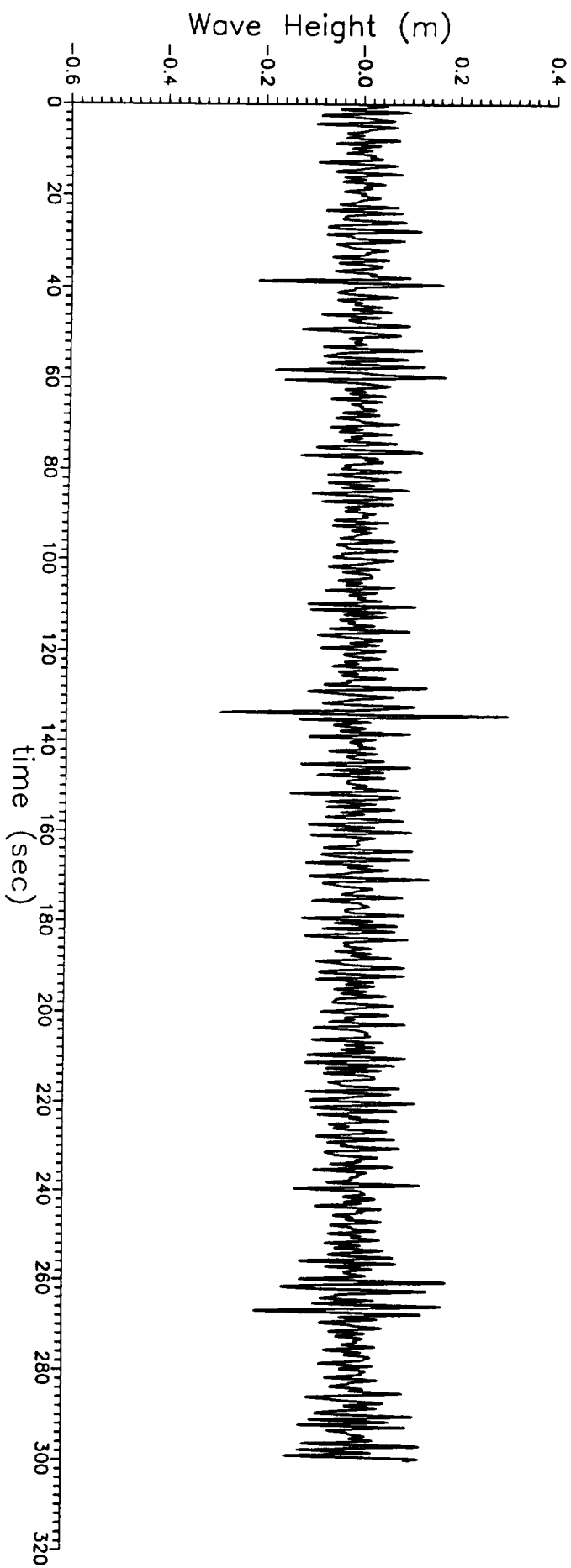
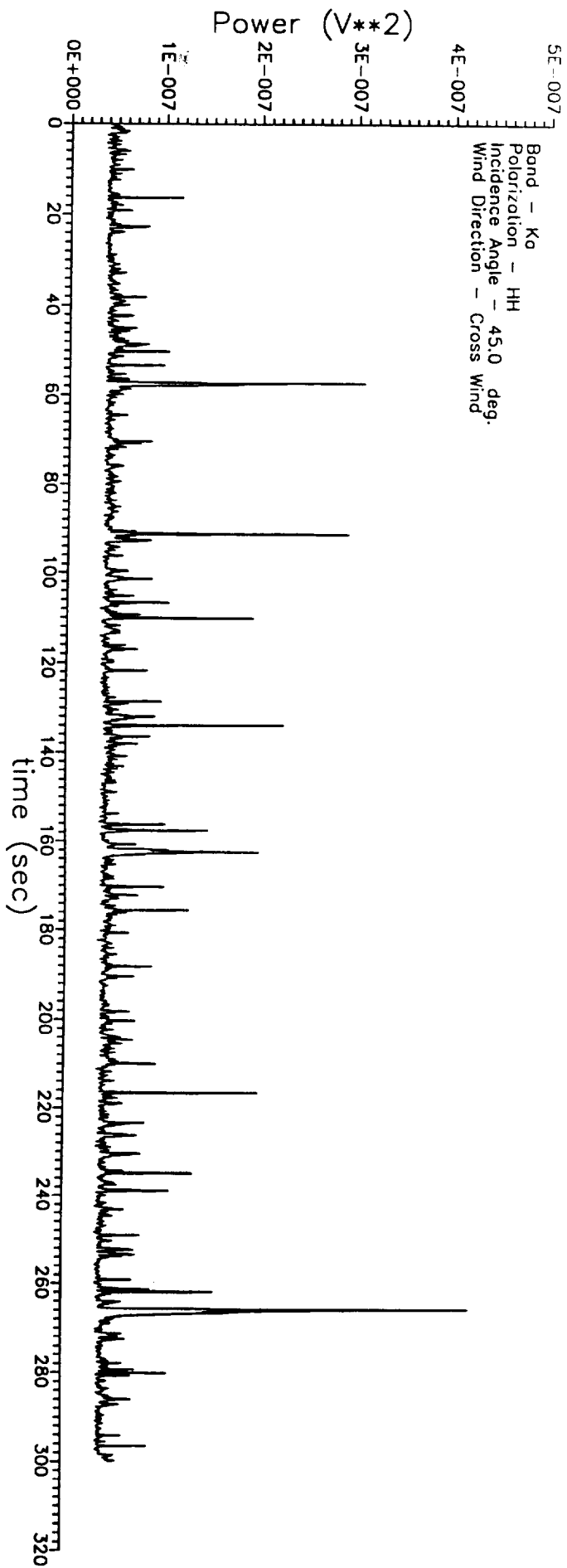


Run 29 , 20:26, July 18, 1990

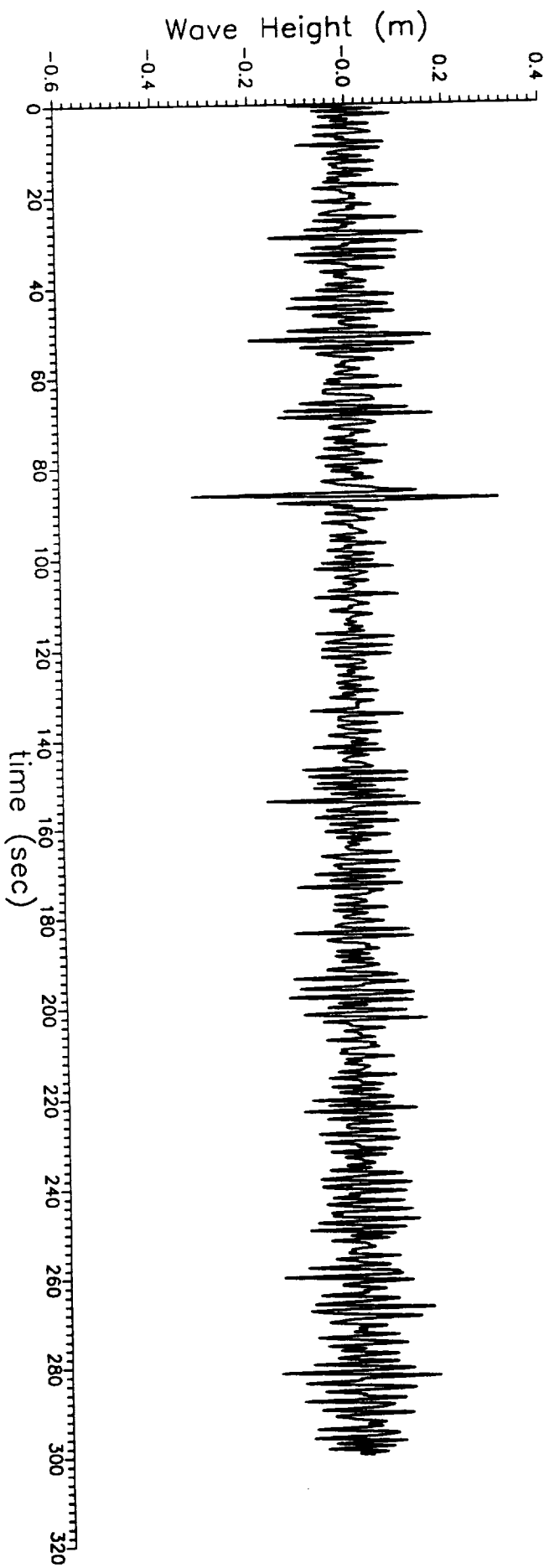
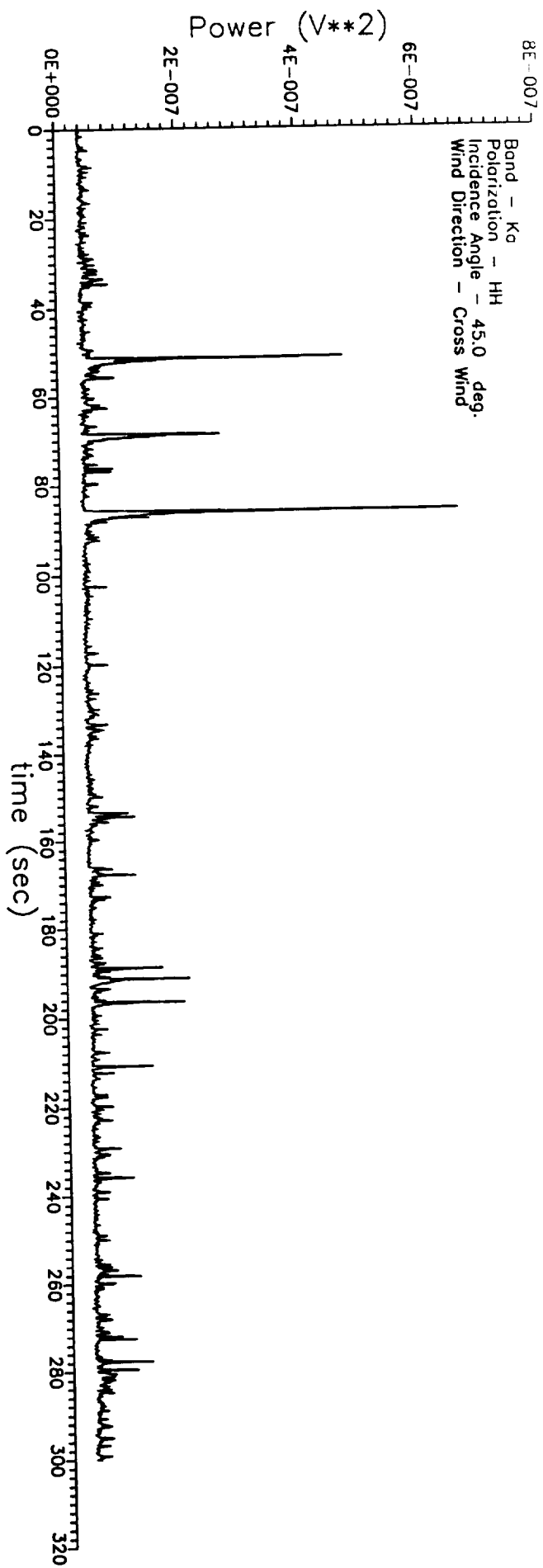
6E-007
Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind

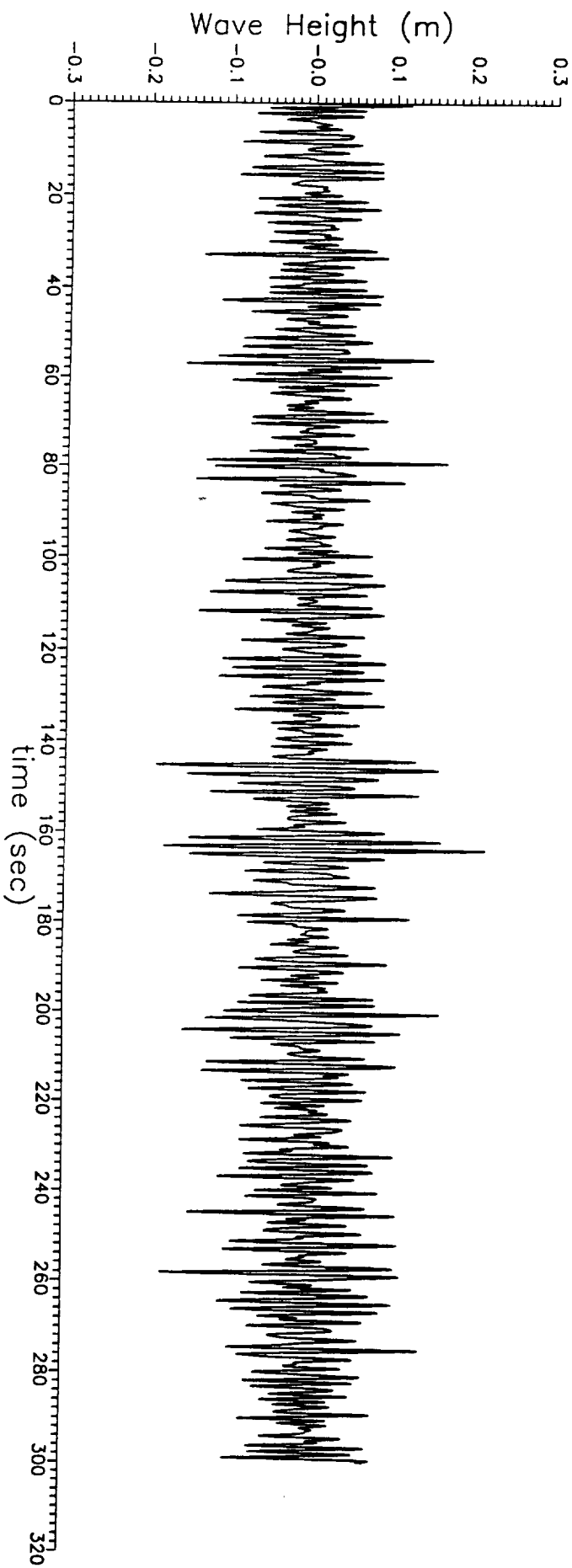
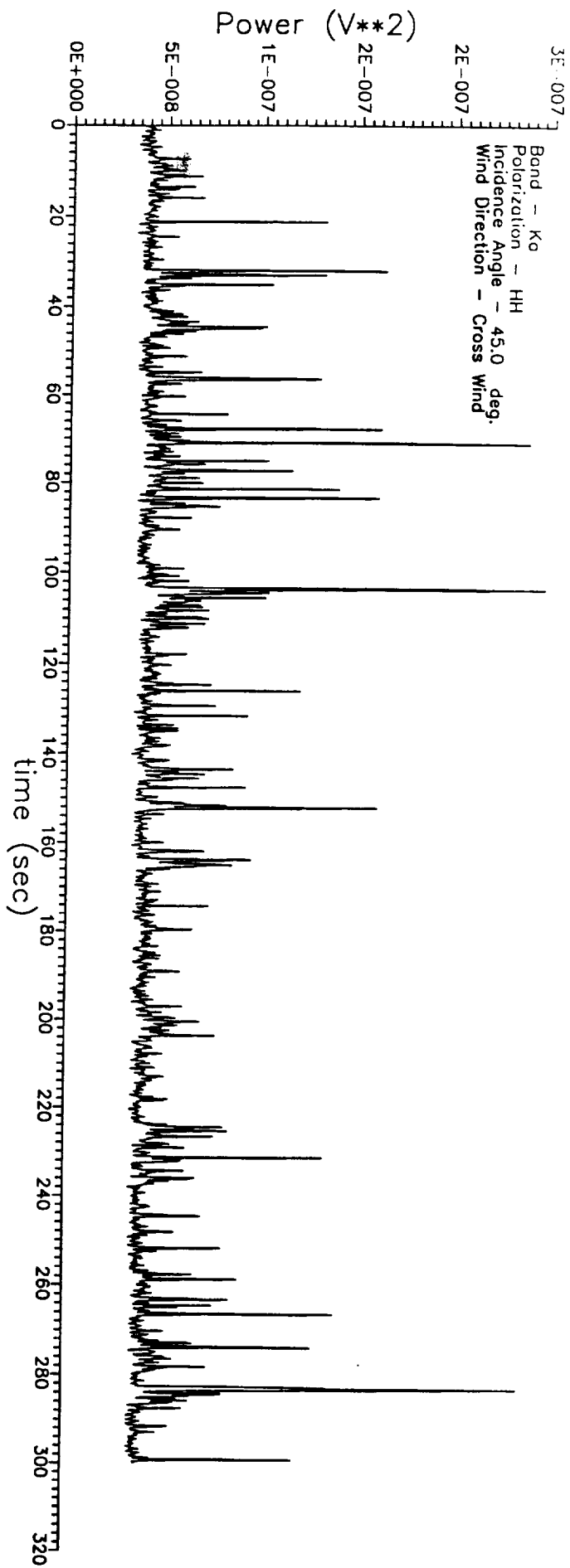


Band - Ko
Polarization - HH
Incidence Angle - 45.0 deg.
Wind Direction - Cross Wind



Run 32 , 20:43, July 18, 1990



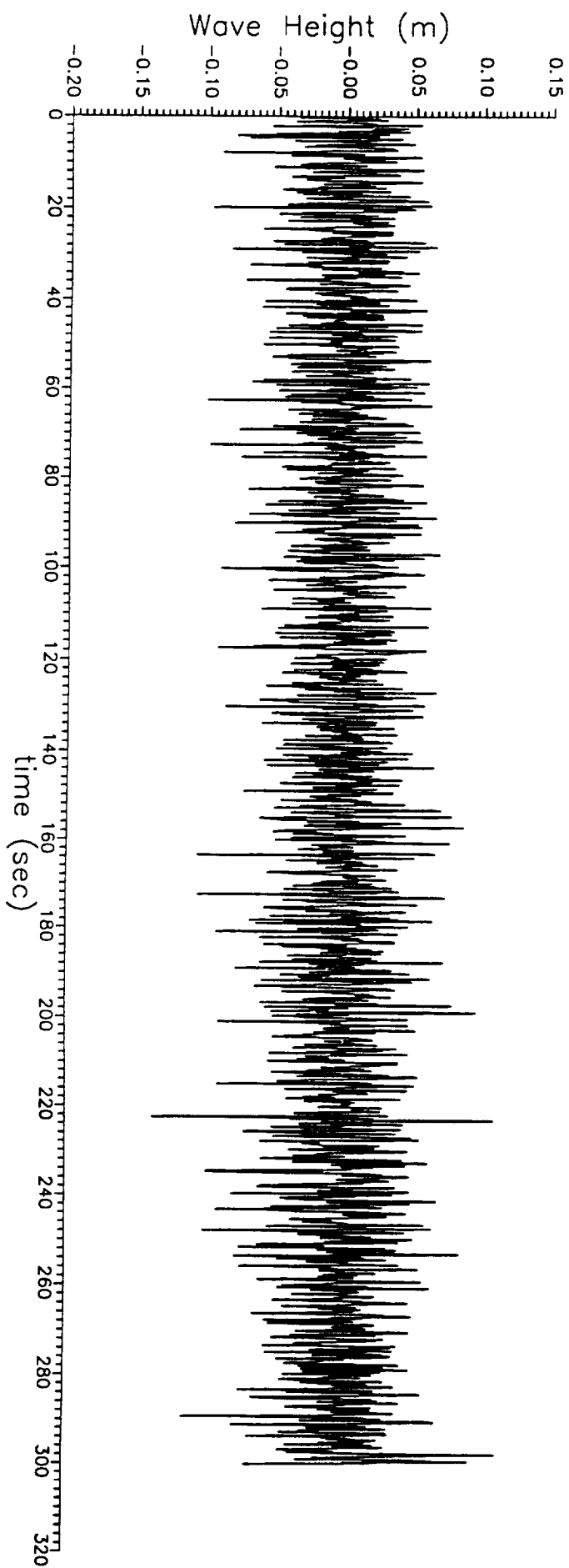
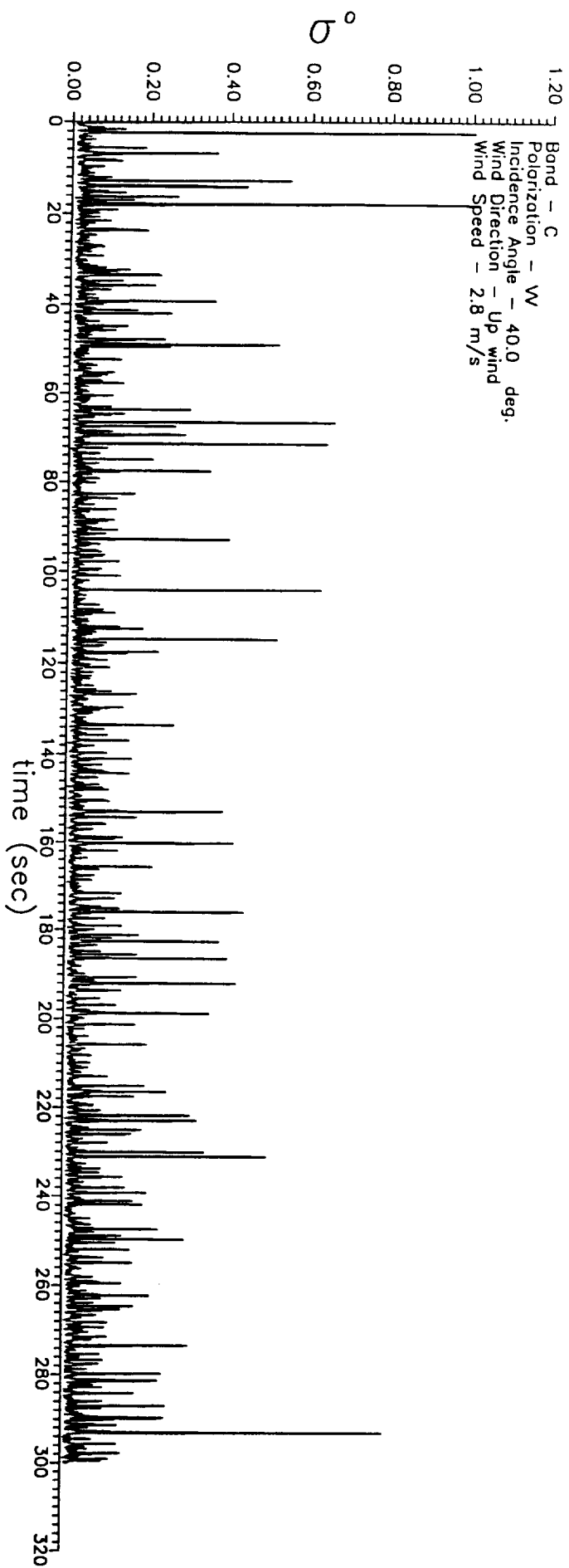




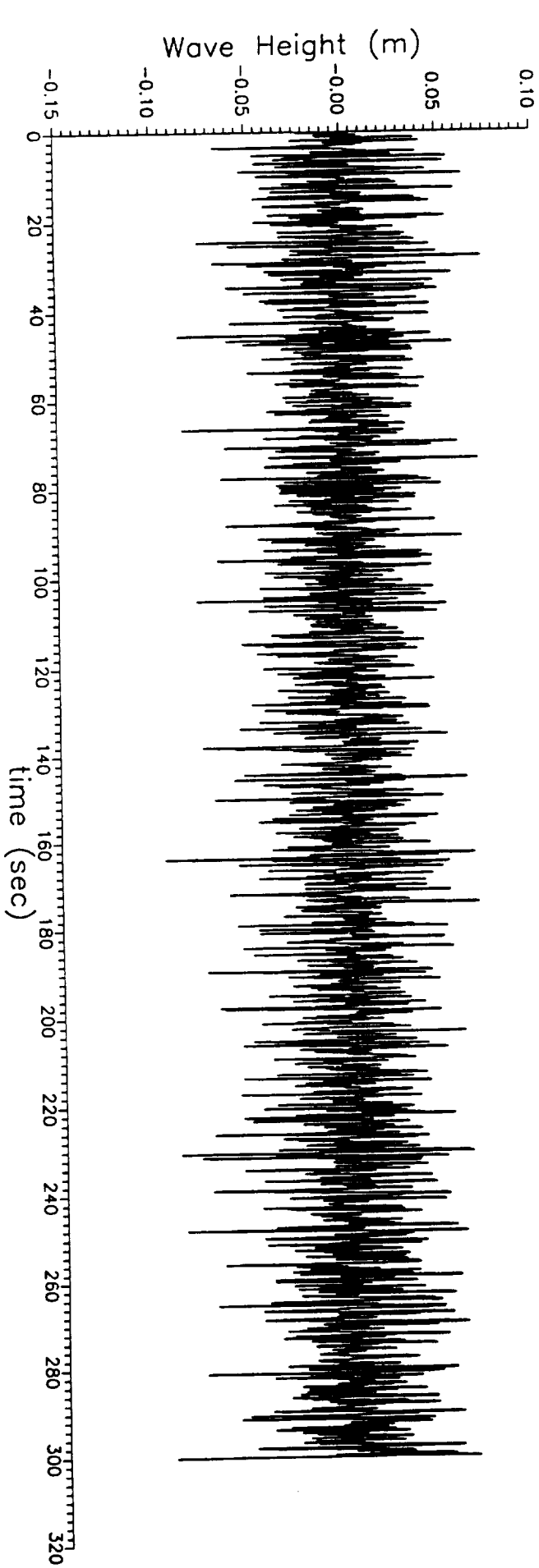
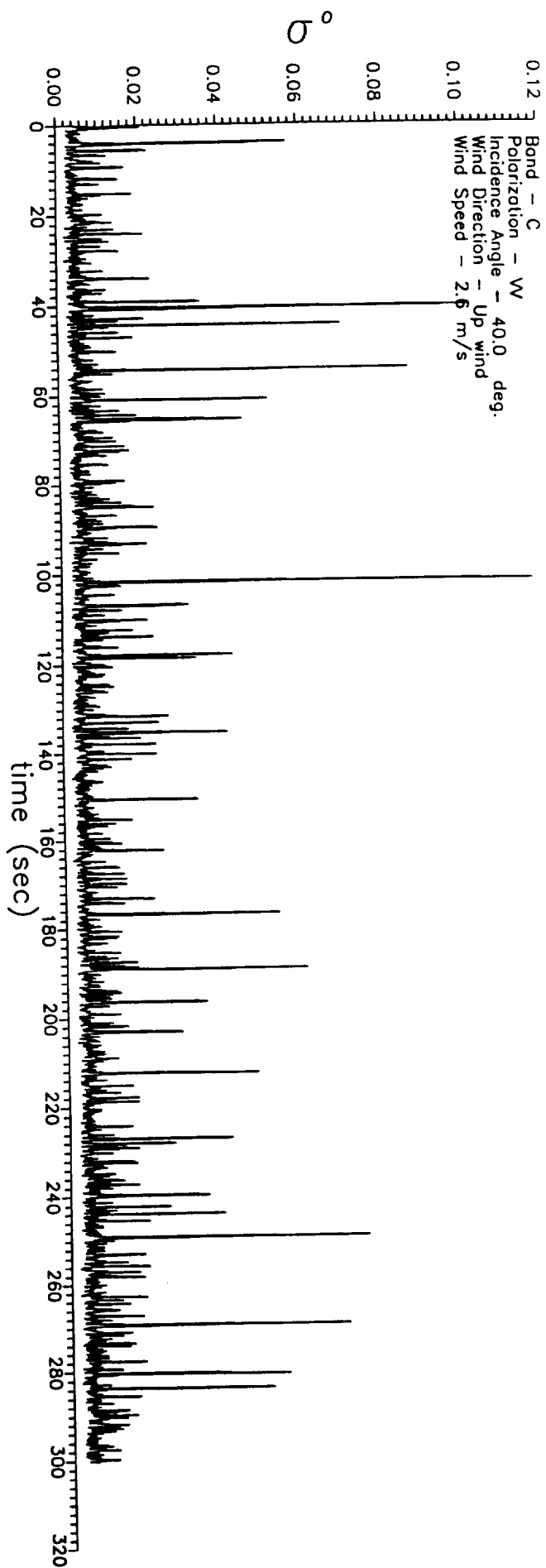
Appendix B
Plots of σ^0 and Wave Height

B-1. C Band

Run 21, 15:48, July 12, 1990

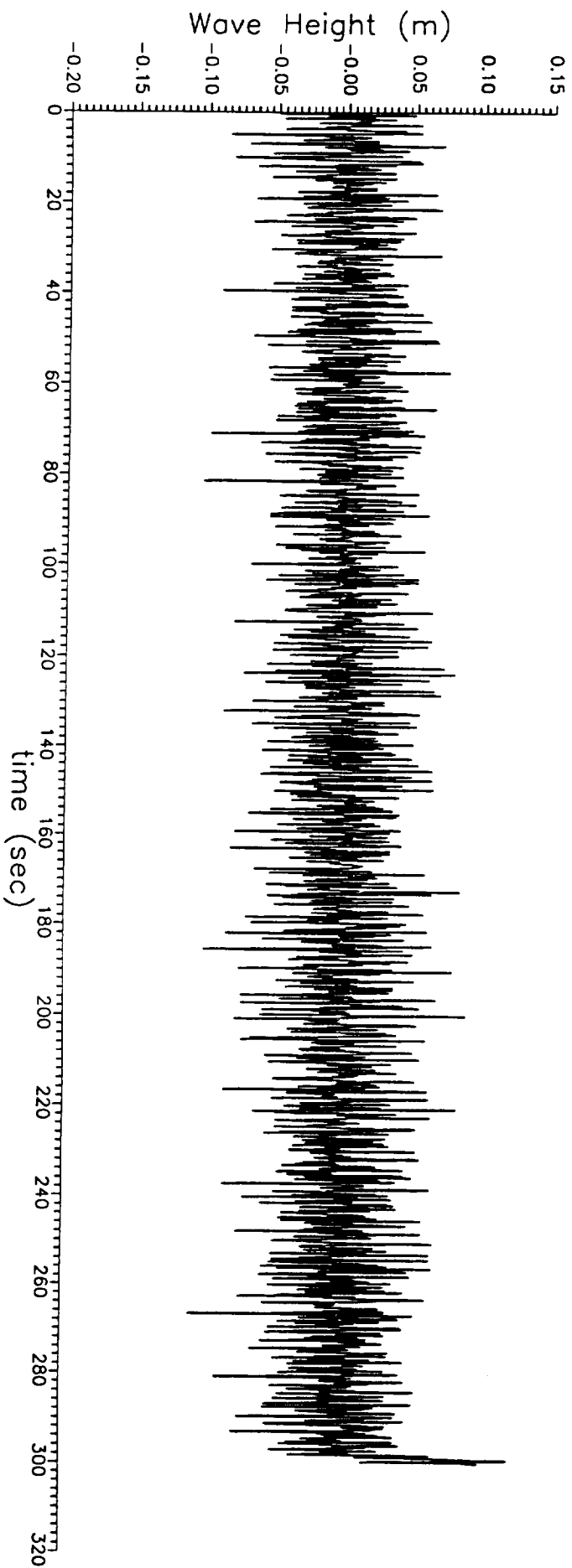
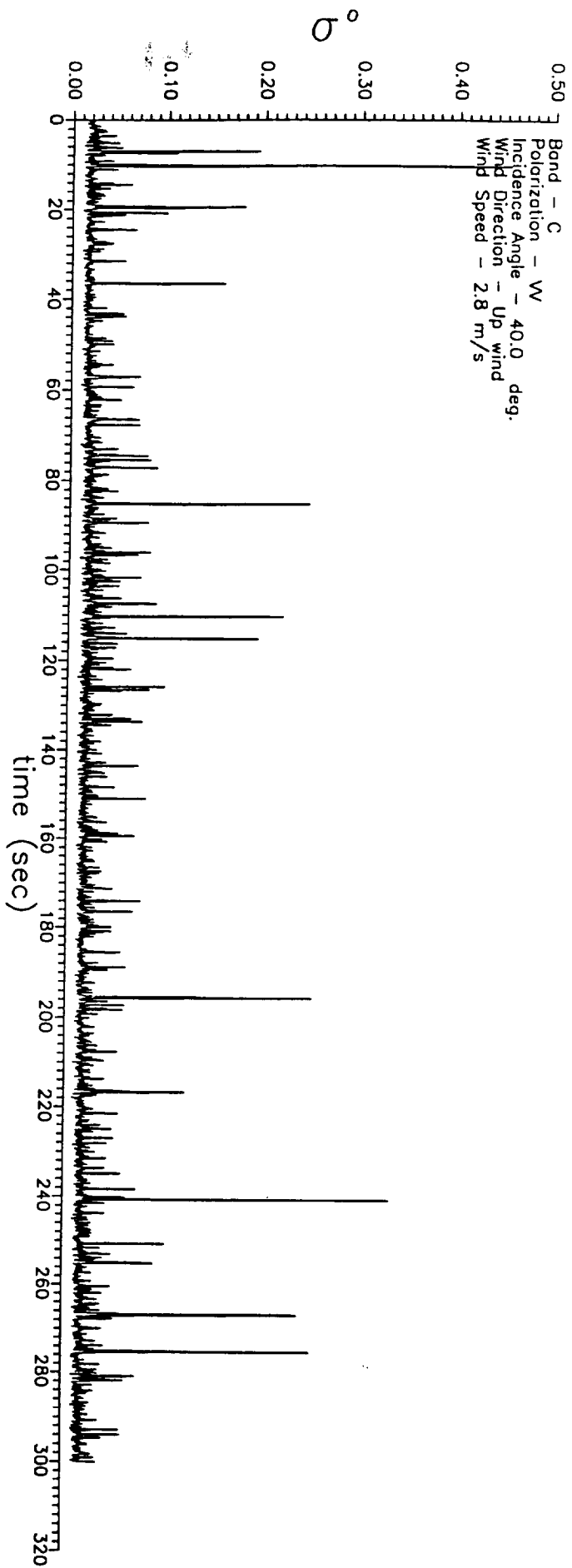


Run 26, 16:21, July 12, 1990

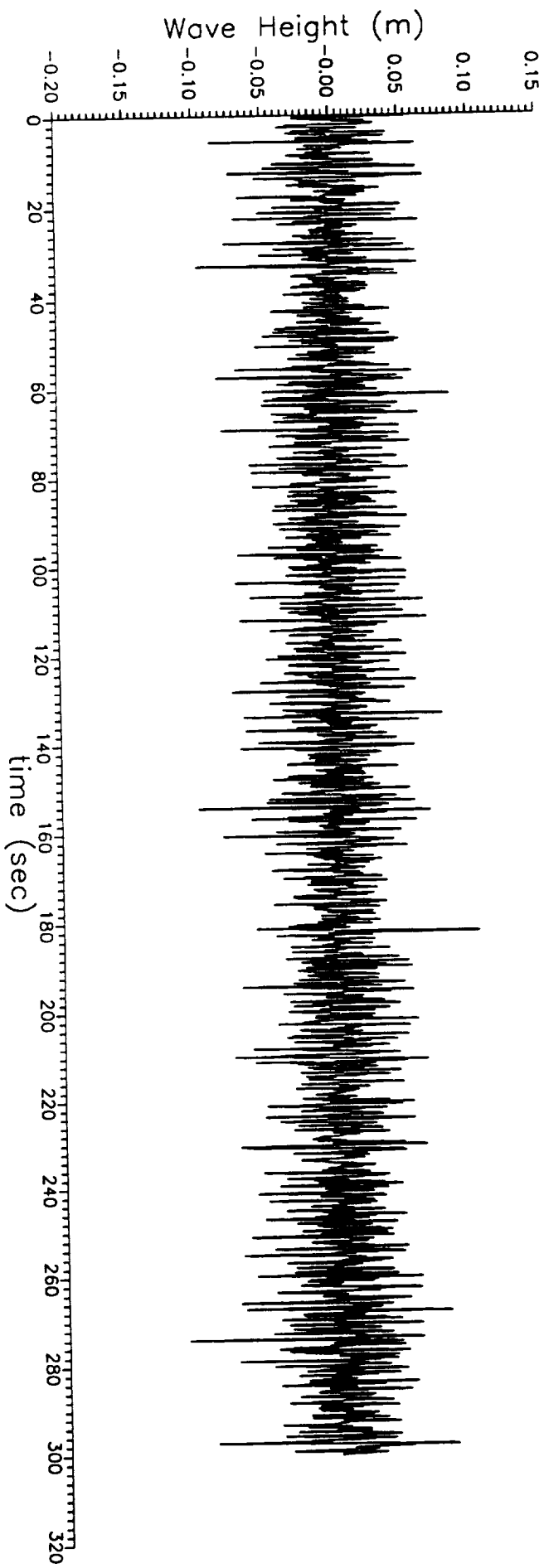
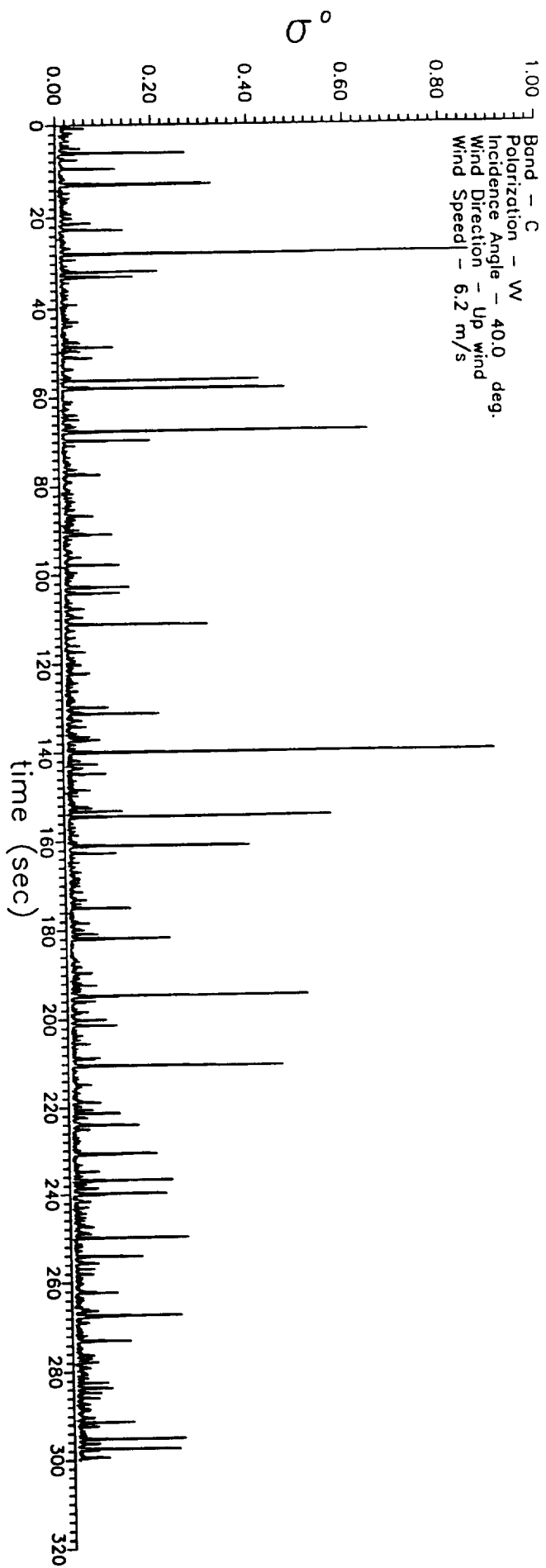


Run 28, 16:40, July 12, 1990

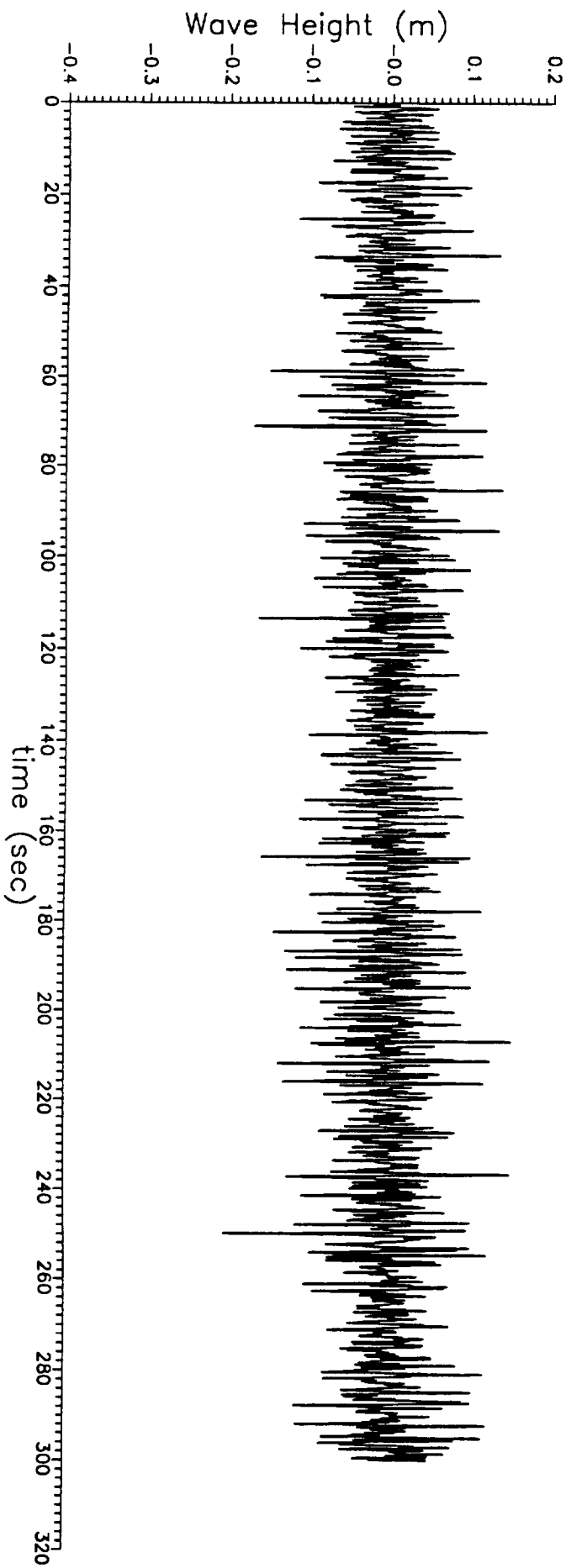
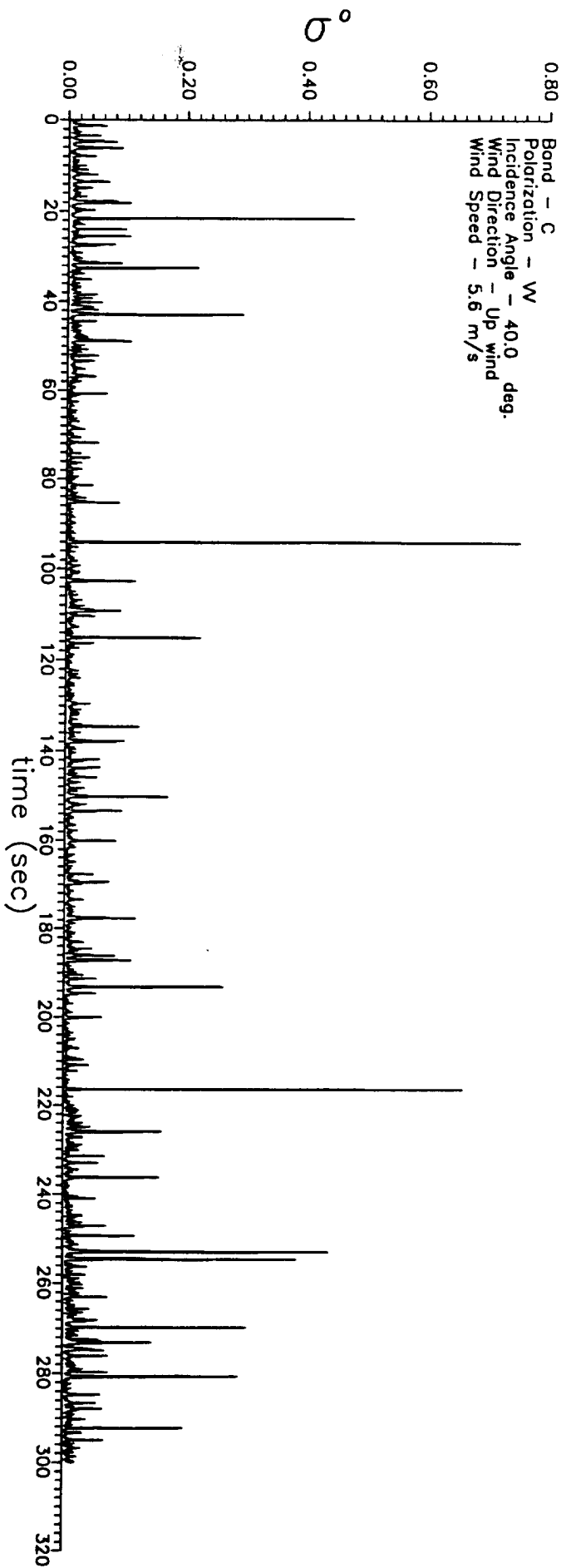
Band - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 2.8 m/s



Run 9, 17:25, July 19, 1990

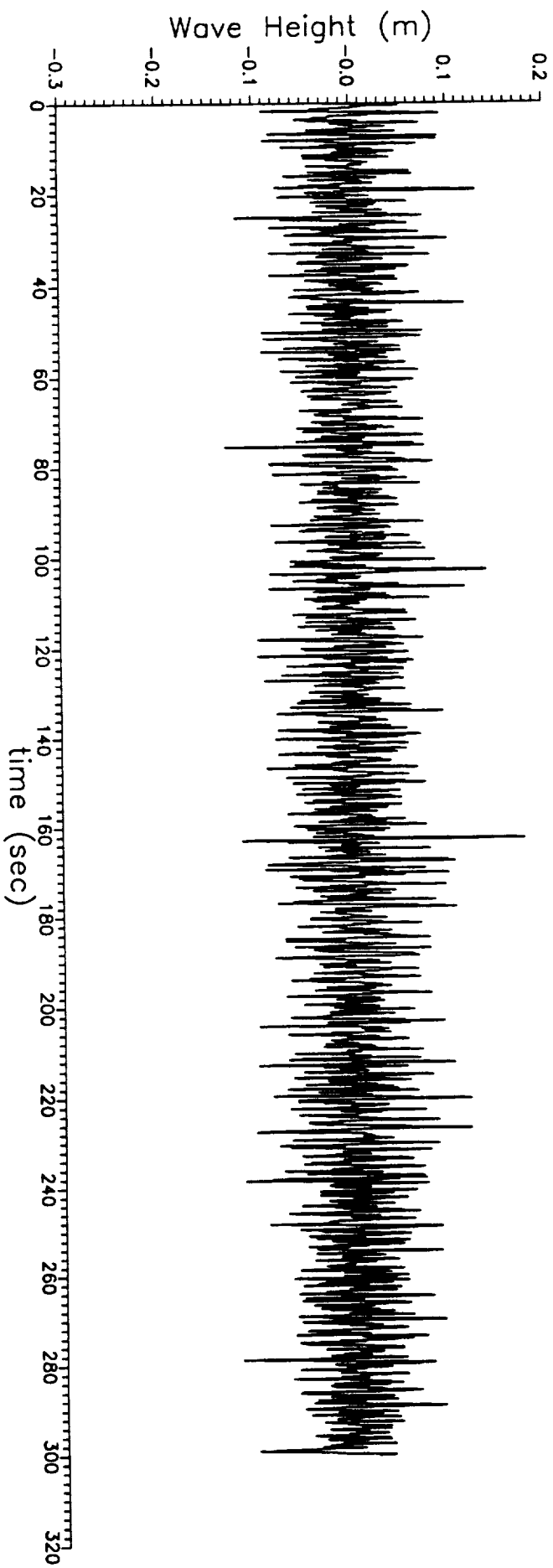
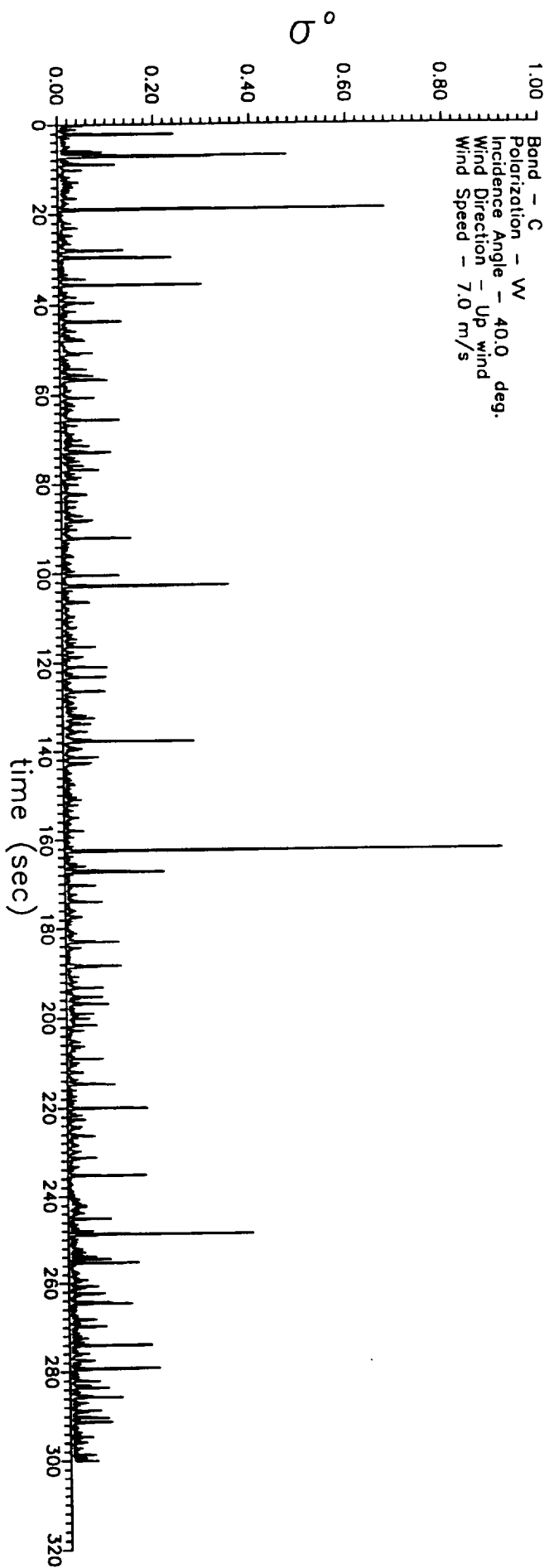


Run 15, 18:11, July 19, 1990

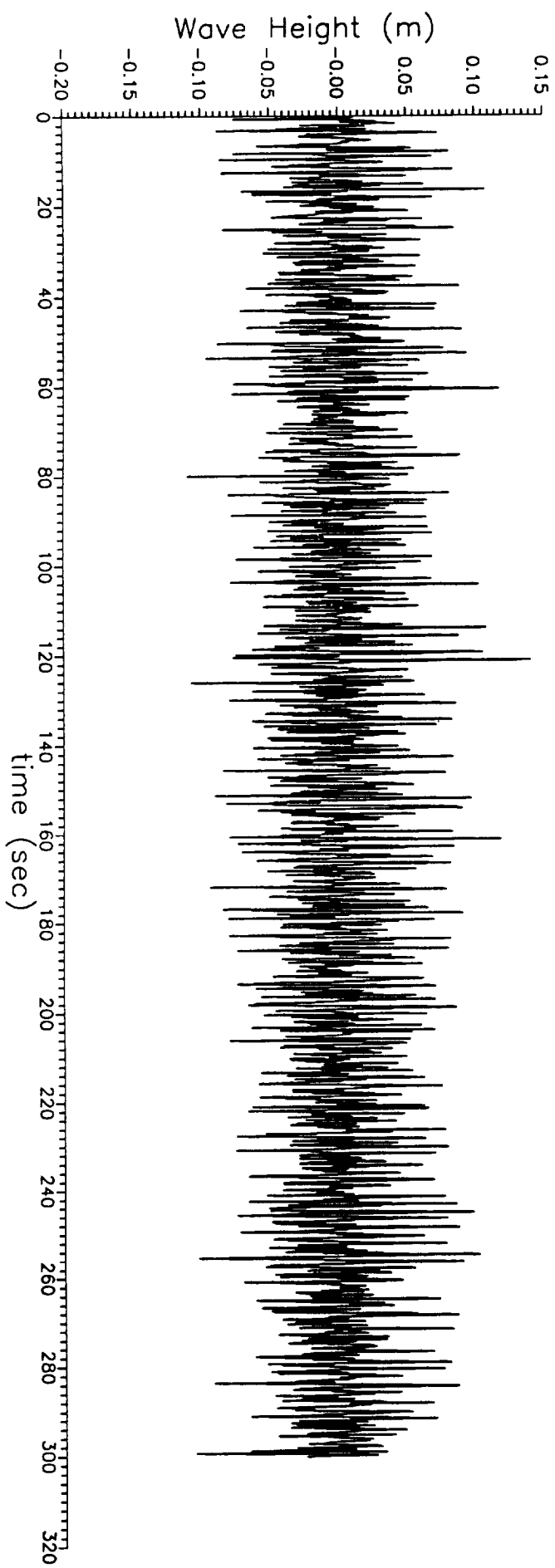
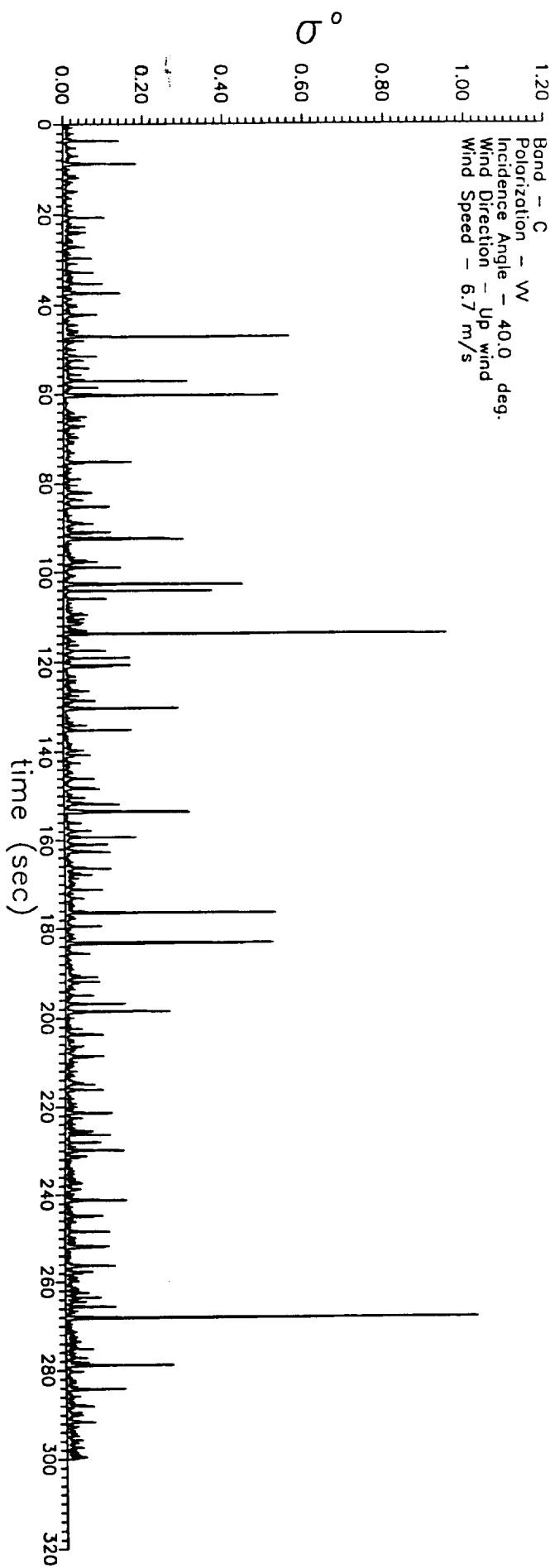


Run 16, 18:17, July 19, 1990

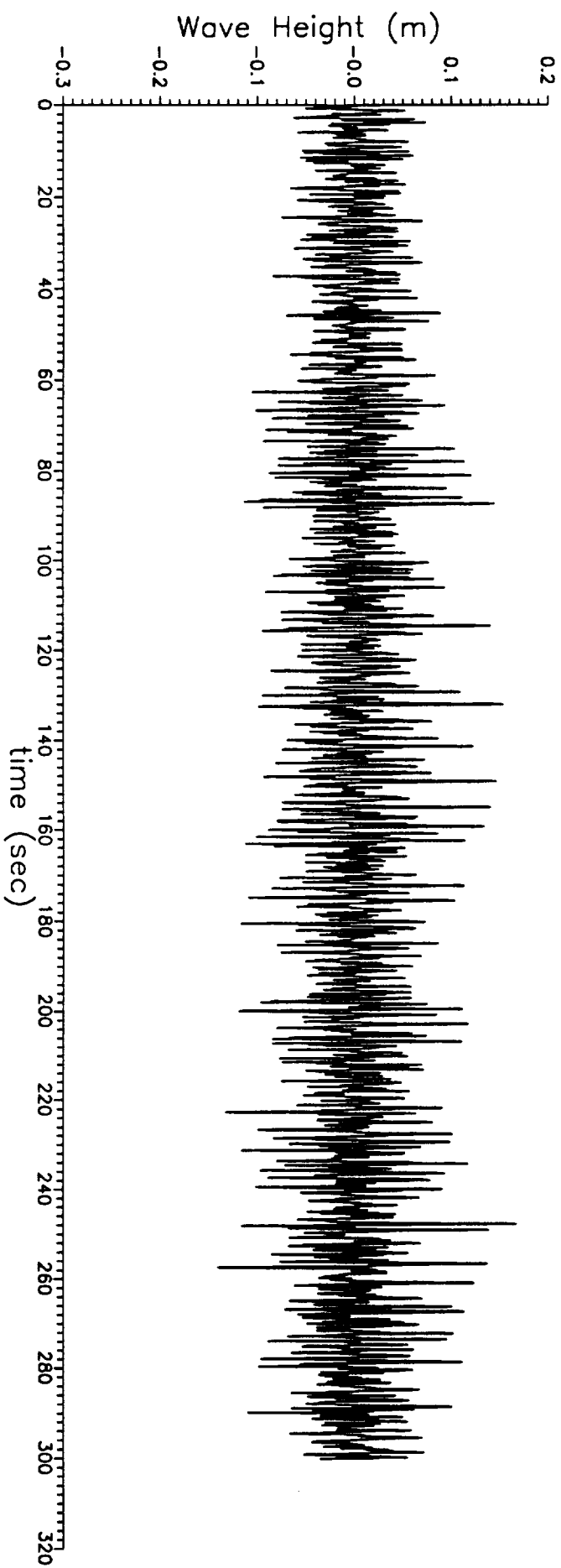
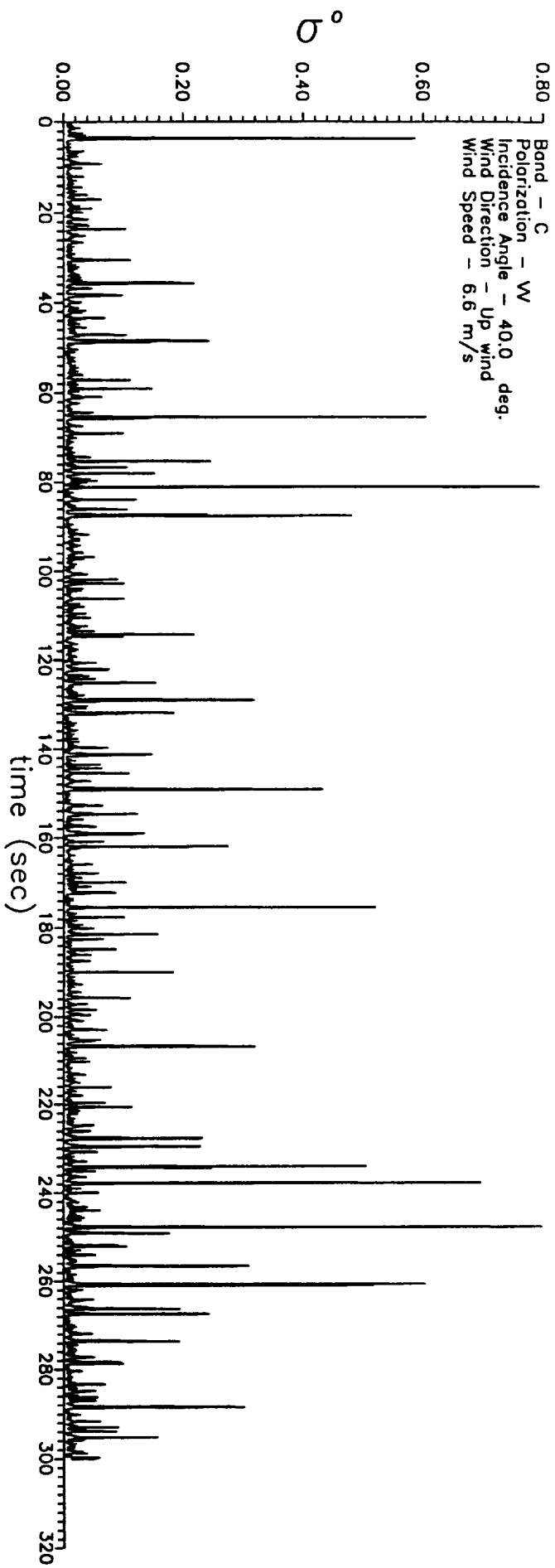
Bond - C
Polarization - W
Incidence Angle - 40.0 deg.
Wind Direction - Up wind
Wind Speed - 7.0 m/s

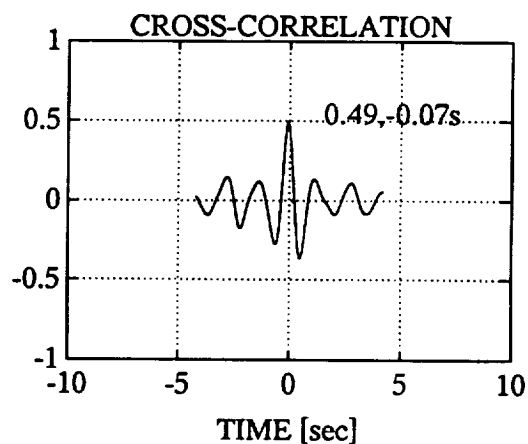
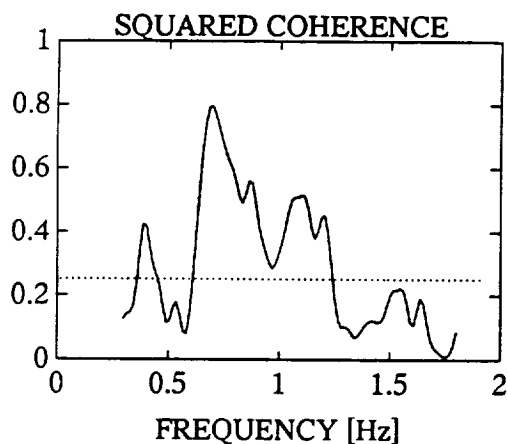
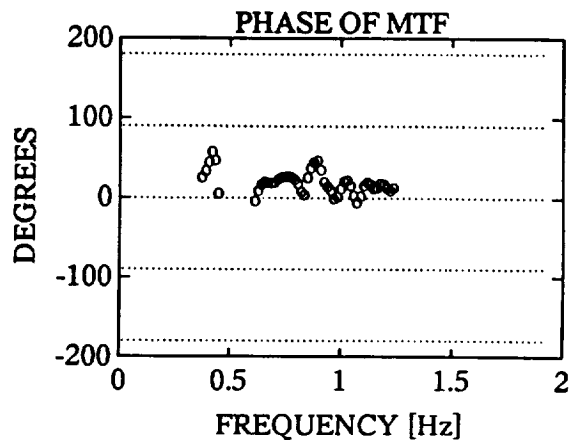
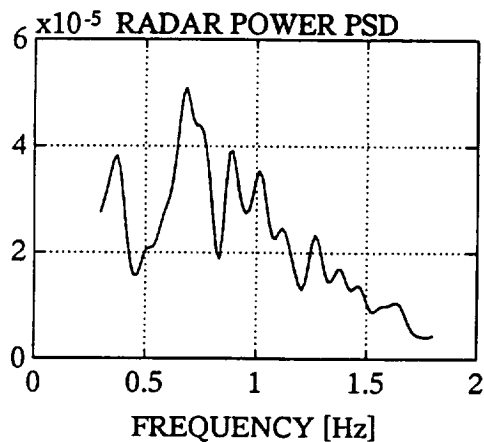
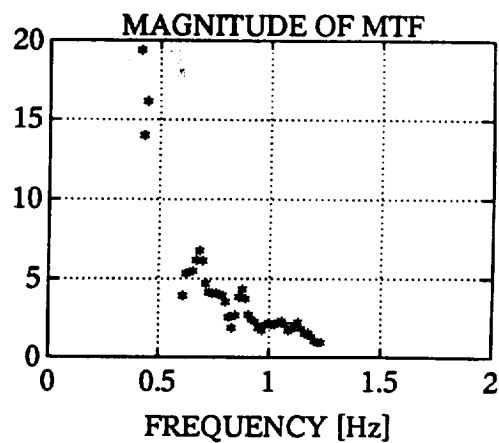
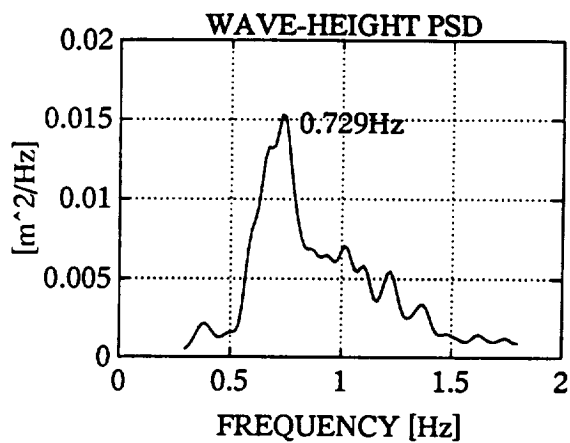


Run 17, 18:22, July 19, 1990

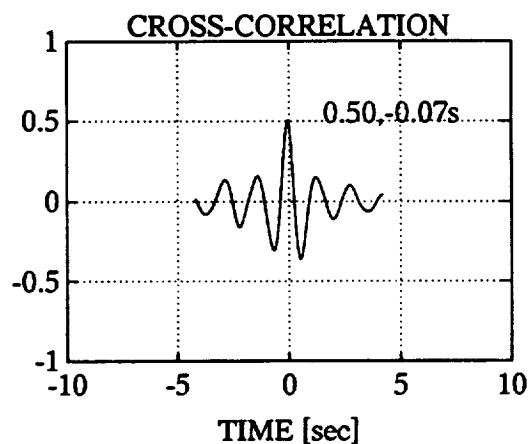
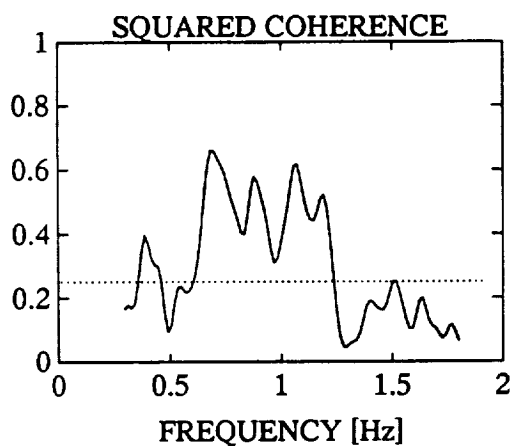
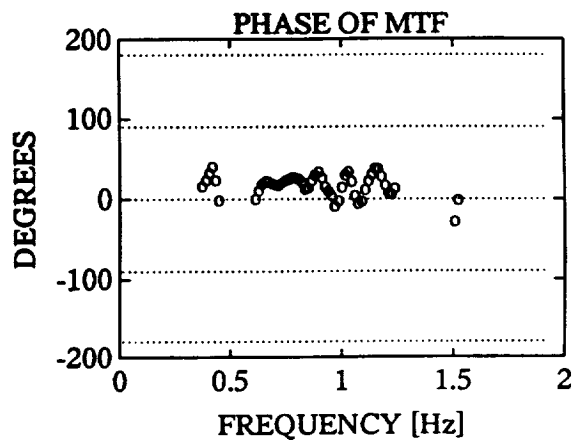
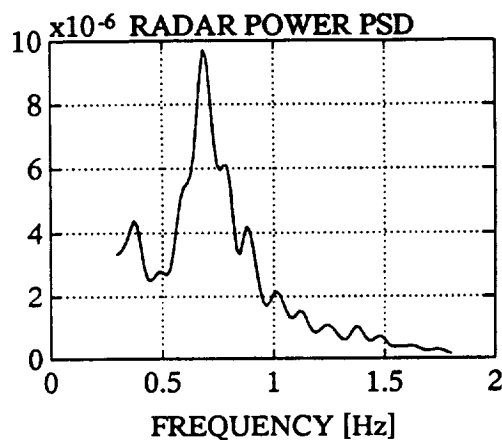
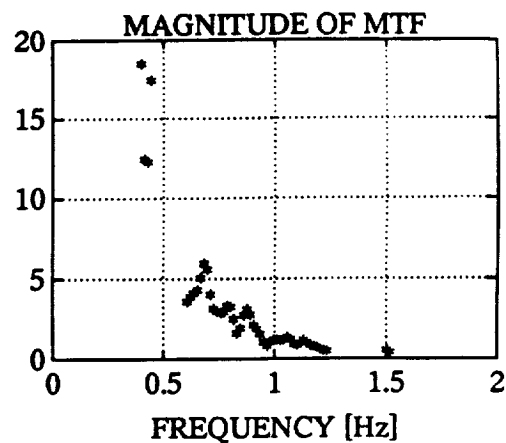
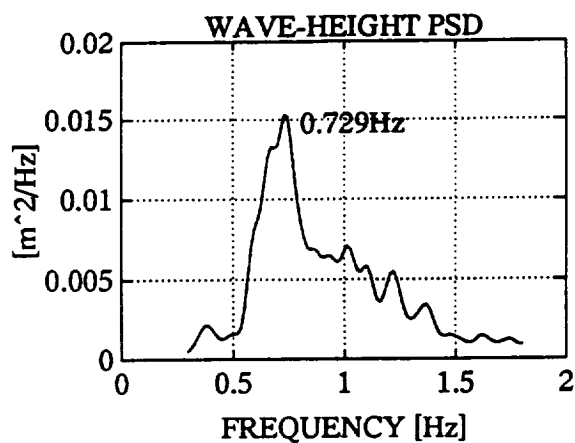


Run 18, 18:28, July 19, 1990

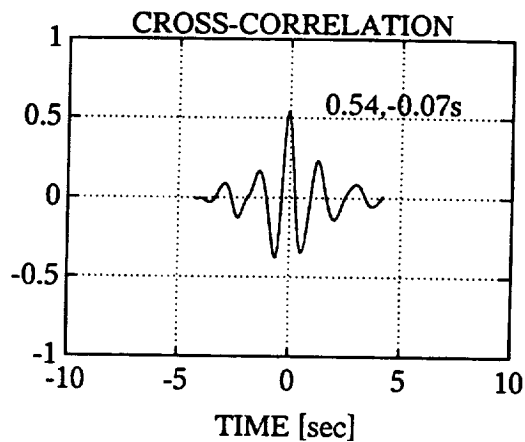
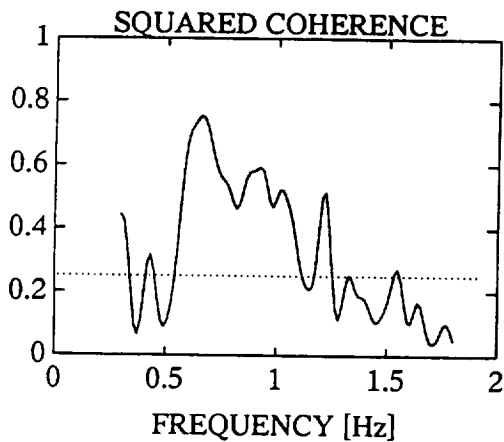
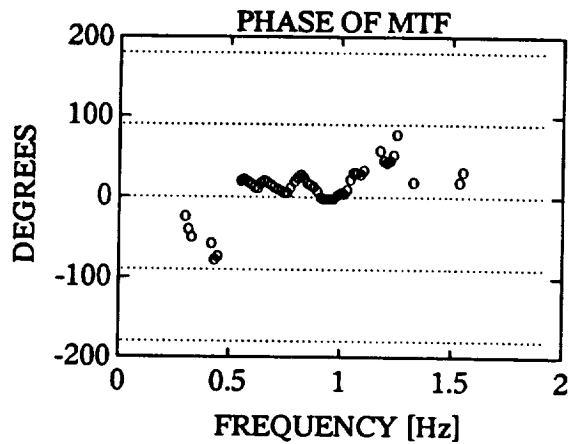
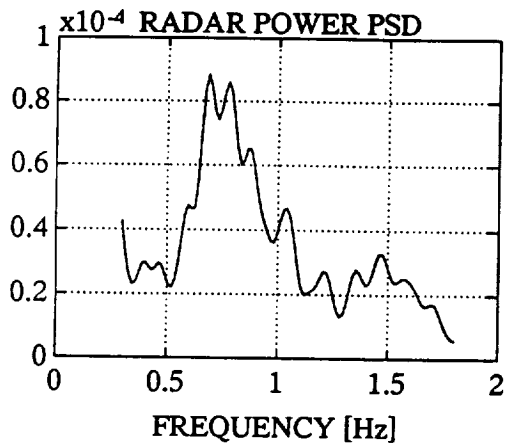
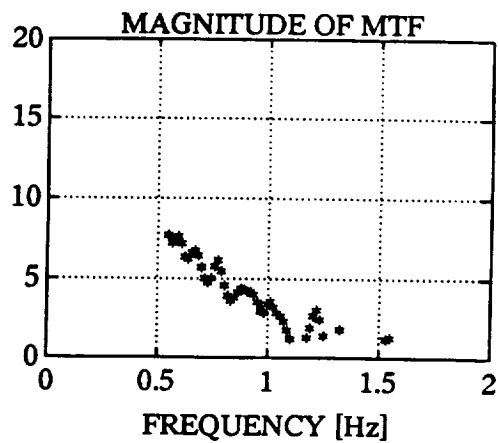
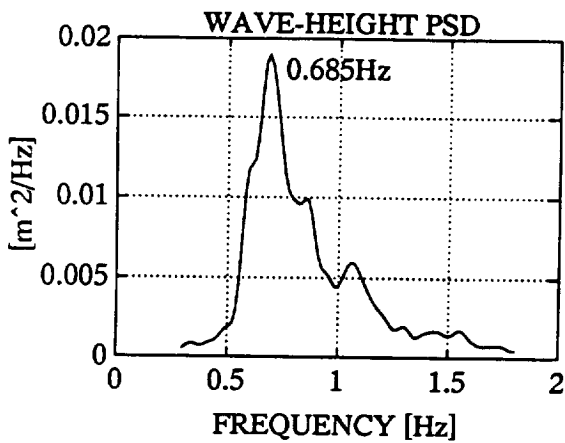




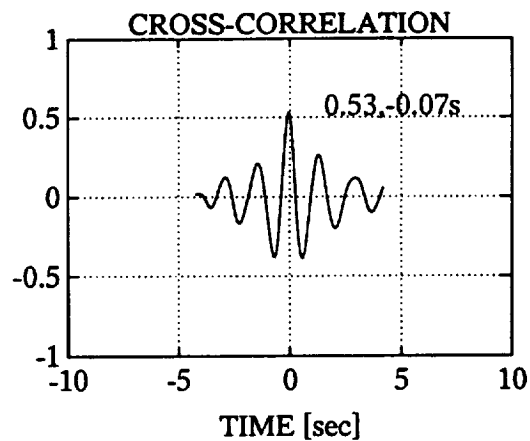
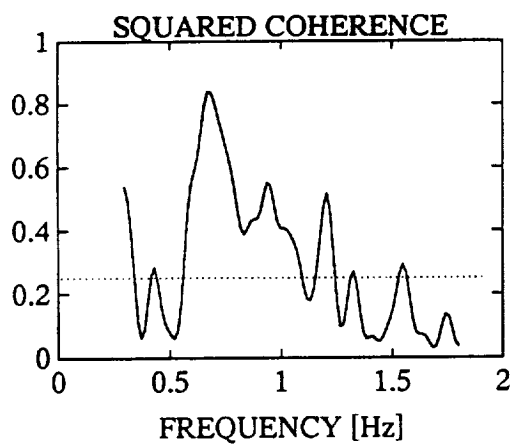
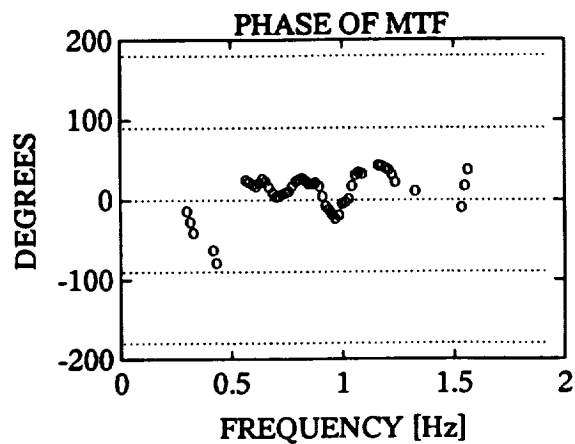
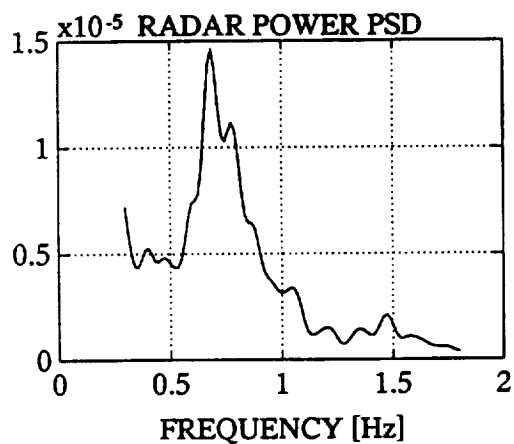
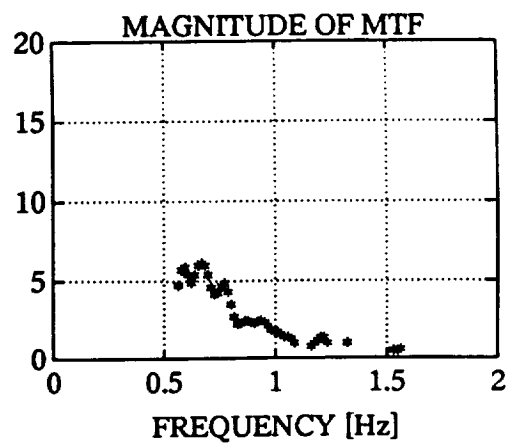
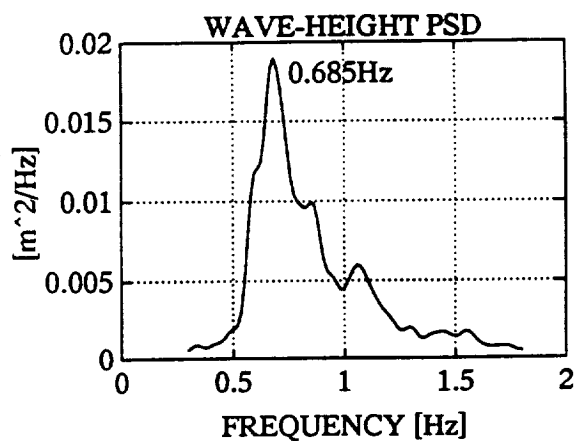
Aug. 3, 1989, Run Time : 20:33:50, Run # 26, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.19 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



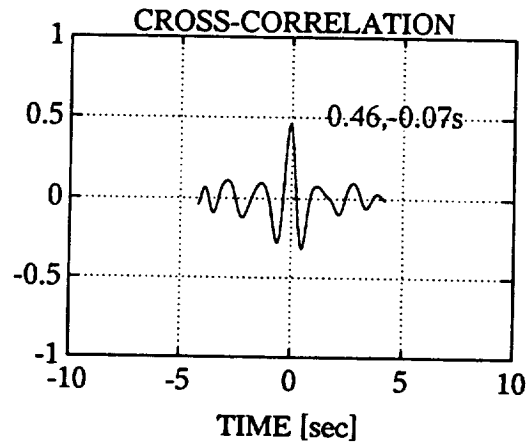
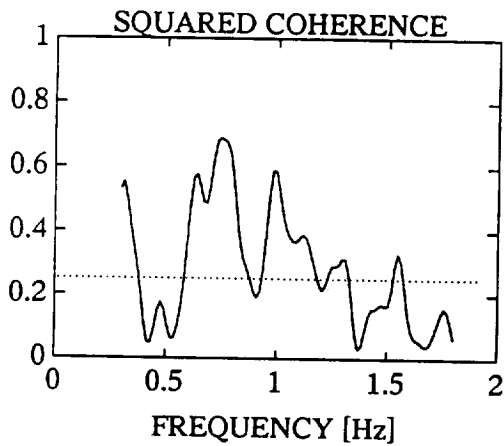
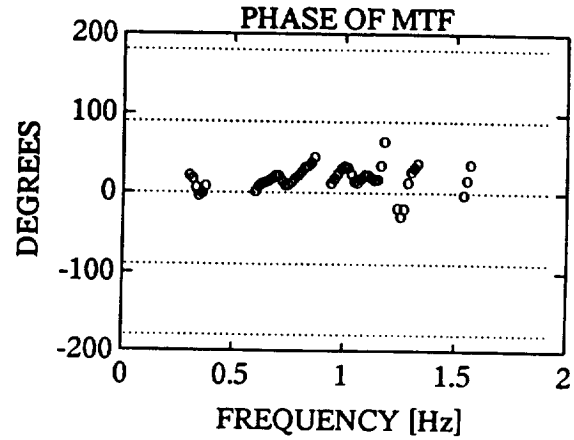
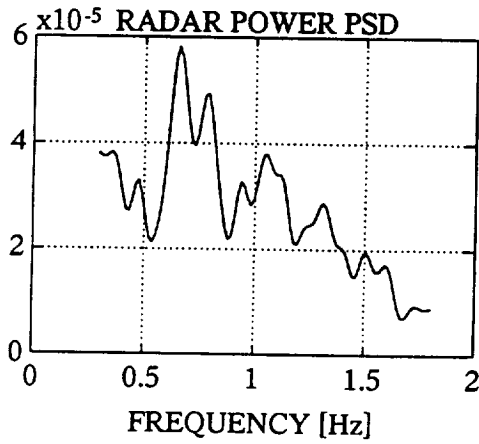
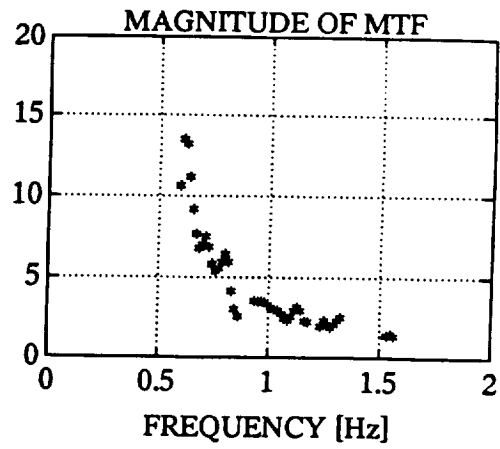
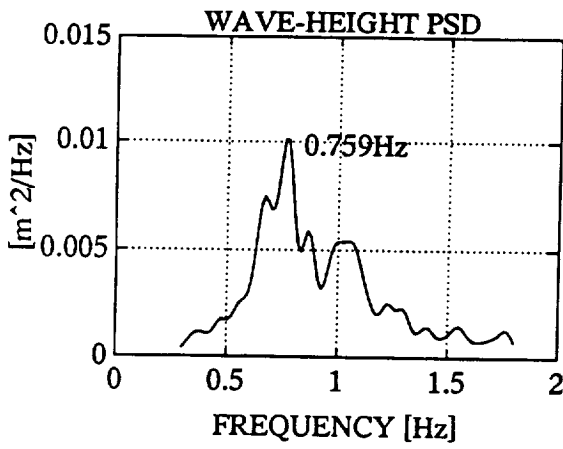
Aug. 3, 1989, Run Time : 20:33:50, Run # 26, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.19 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



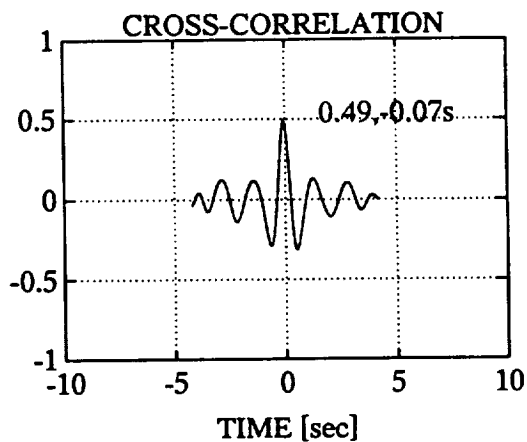
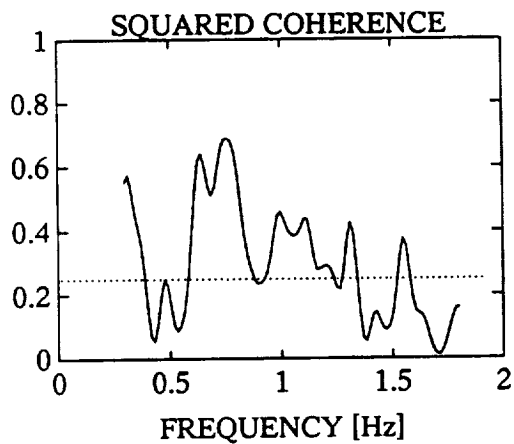
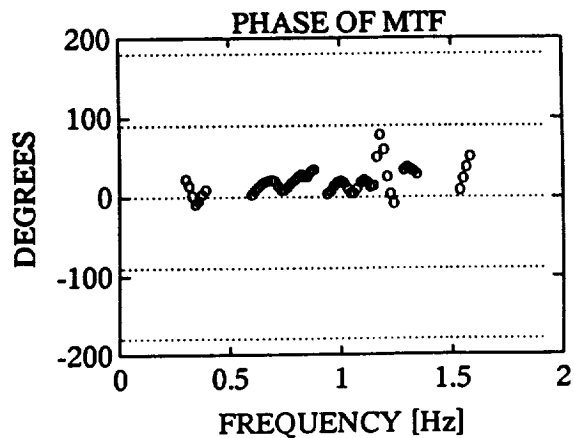
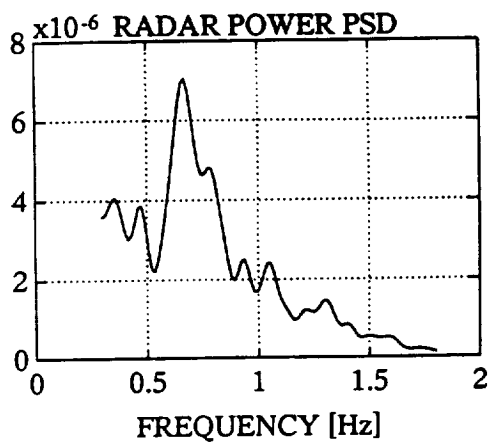
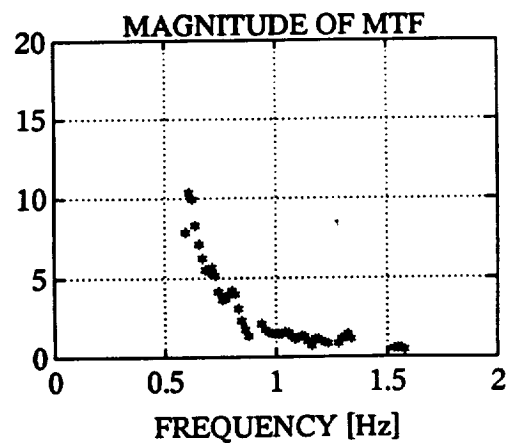
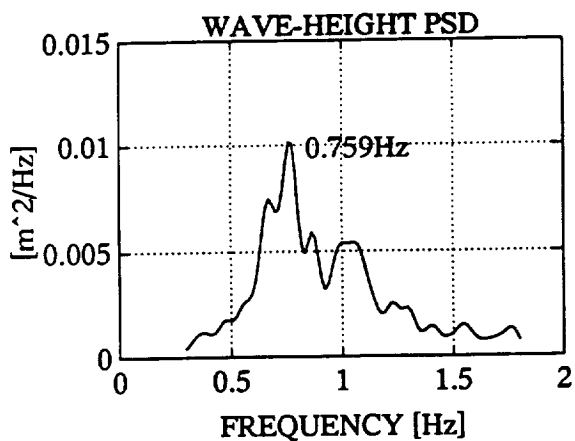
Aug. 3, 1989, Run Time : 20:39:35, Run # 27, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.33 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



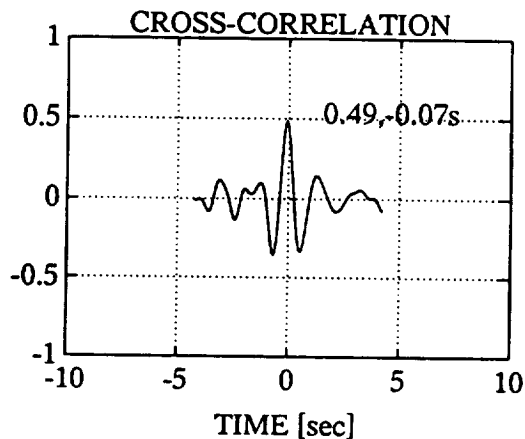
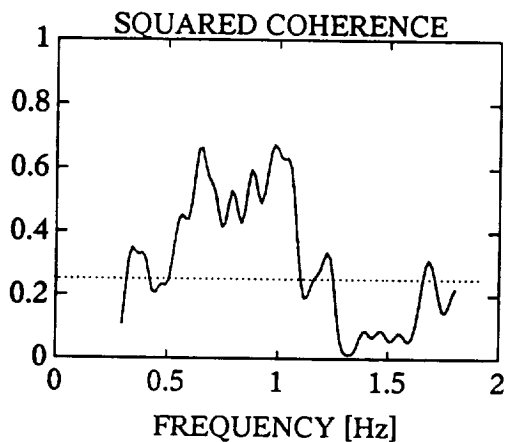
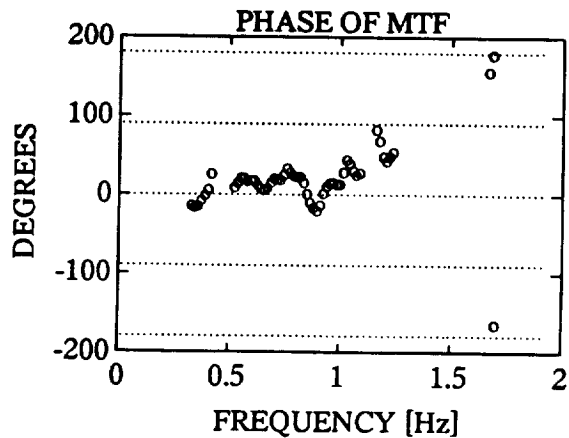
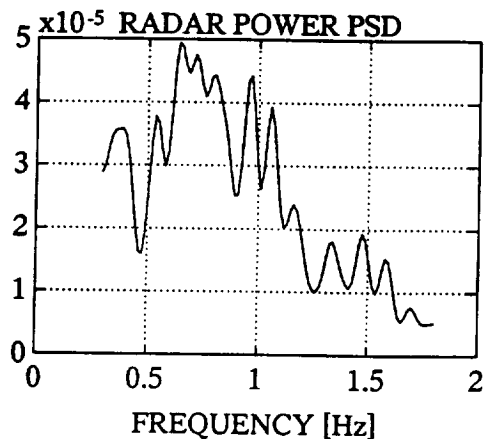
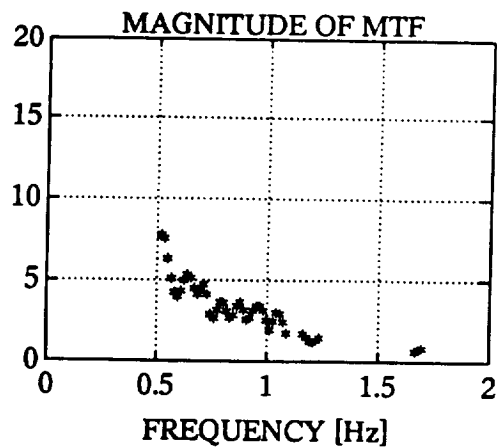
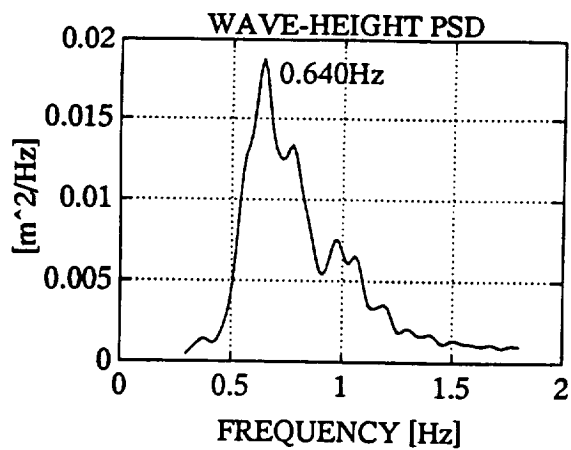
Aug. 3, 1989, Run Time : 20:39:35, Run # 27, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.33 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



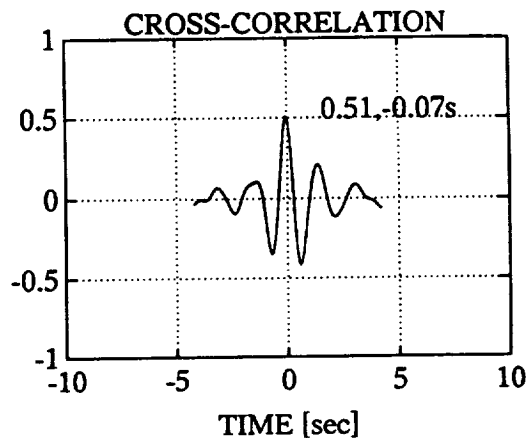
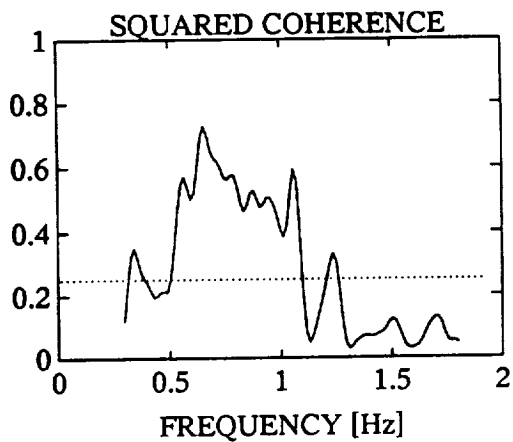
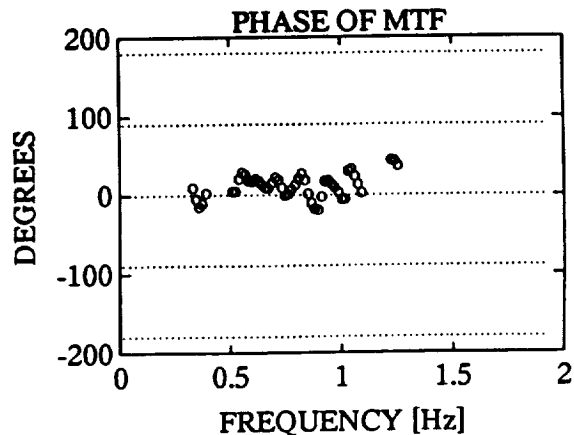
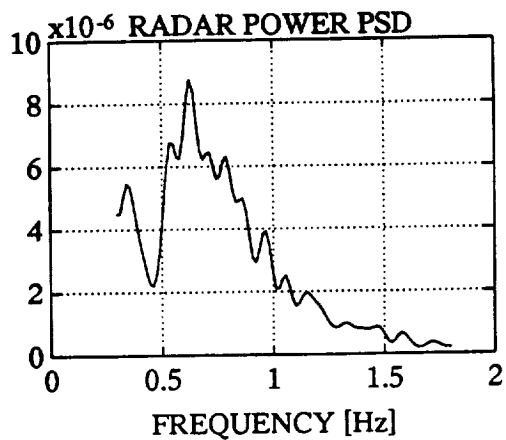
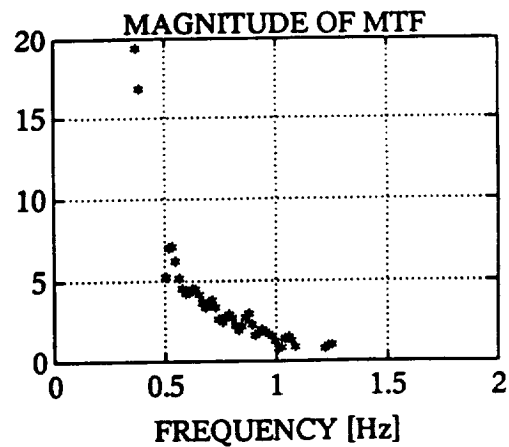
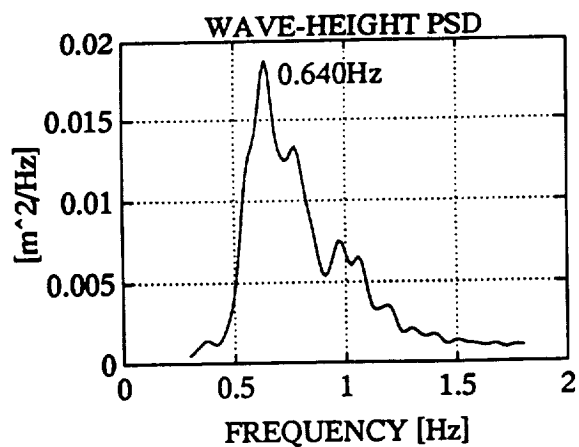
Aug. 3, 1989, Run Time : 20:51: 0, Run # 29, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 2.87 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



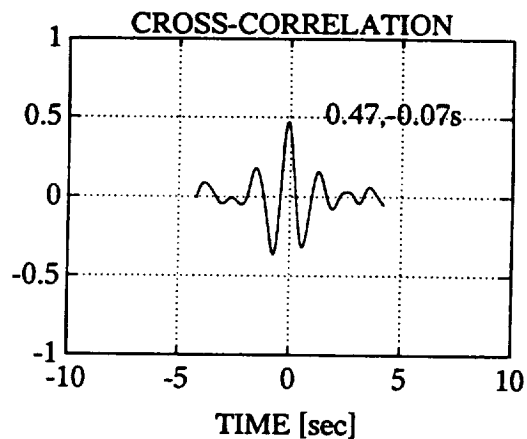
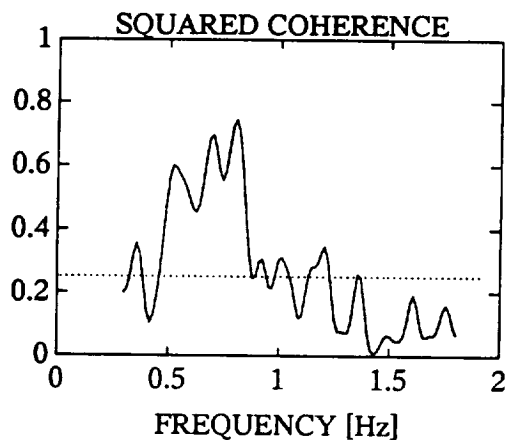
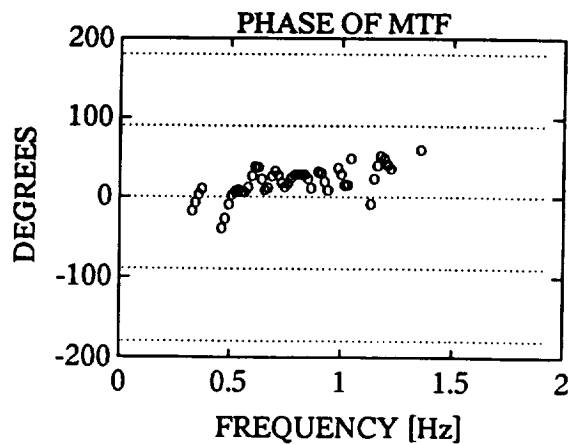
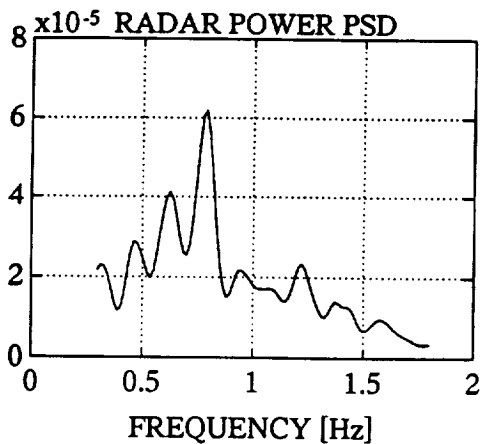
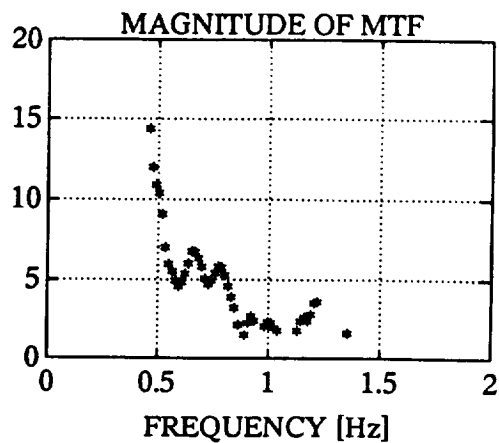
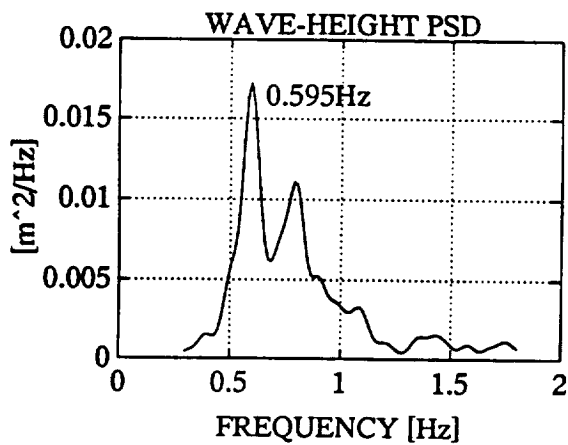
Aug. 3, 1989, Run Time : 20:51: 0, Run # 29, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 2.87 m/s, Air Temp. : 19.4 deg C, Water Temp. : 21.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agearge Threshold)



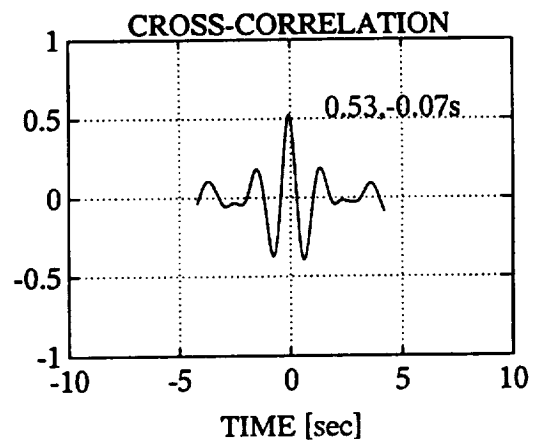
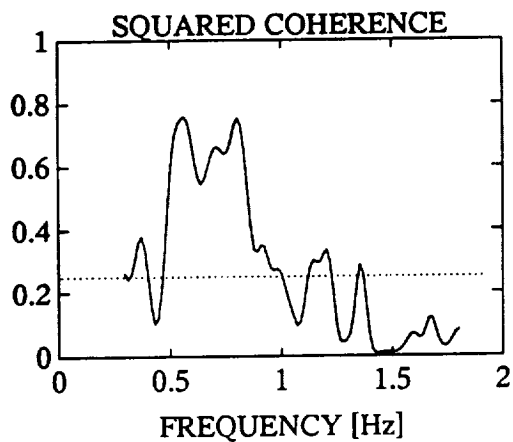
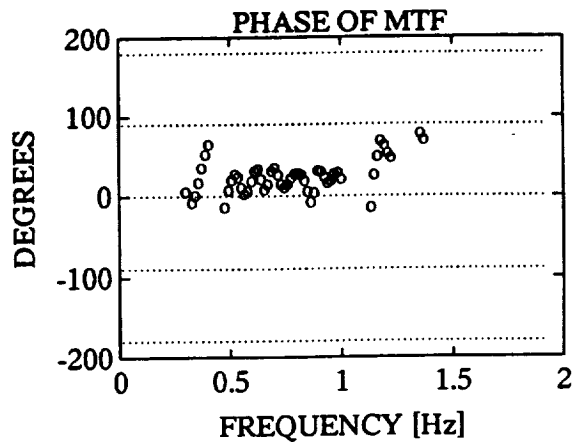
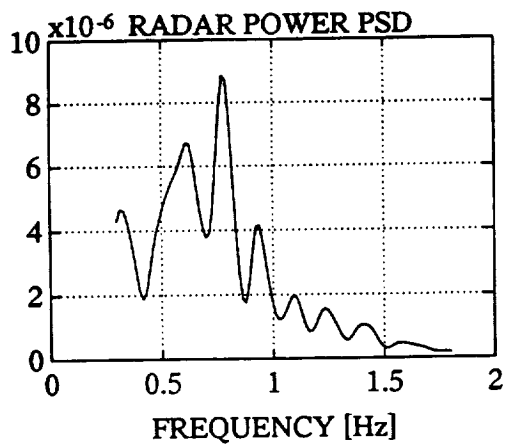
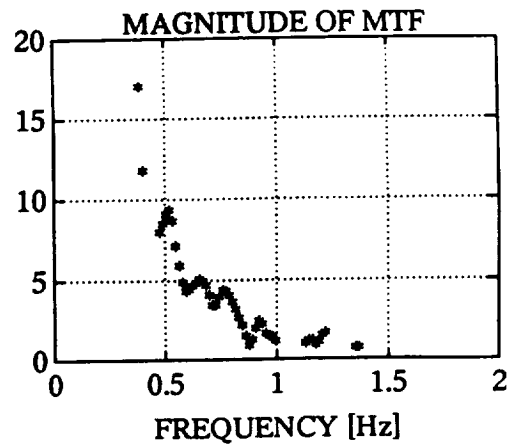
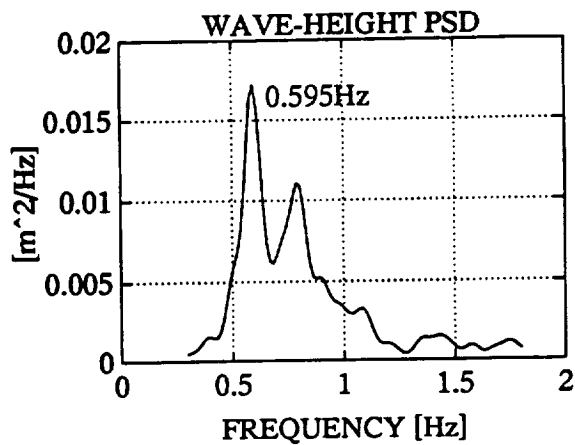
Aug. 4, 1989, Run Time : 17:19:12, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.75 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



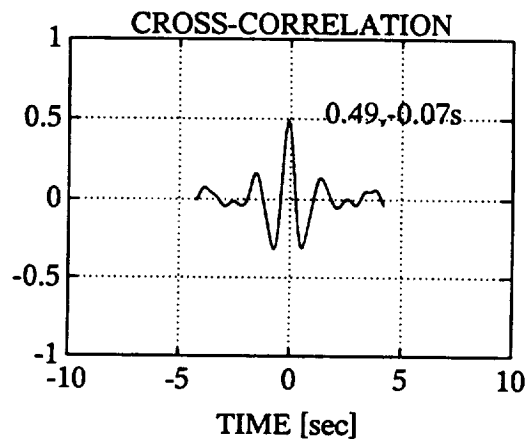
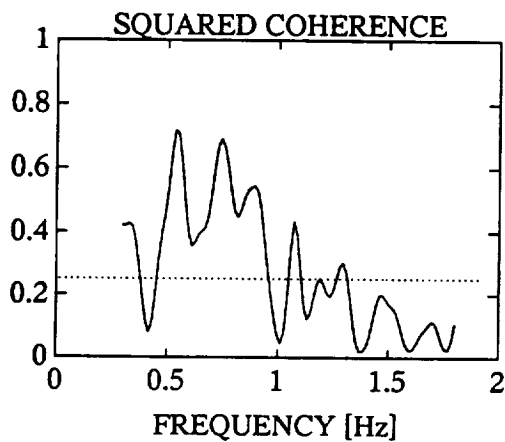
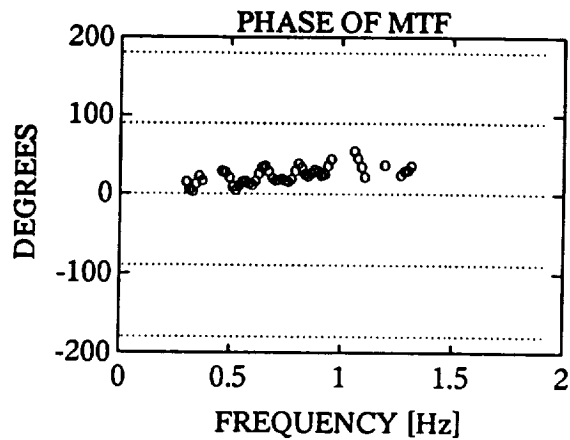
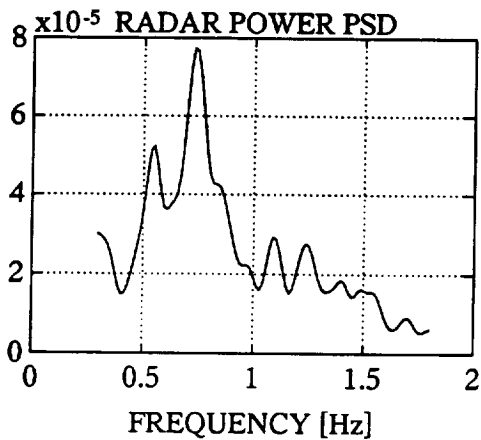
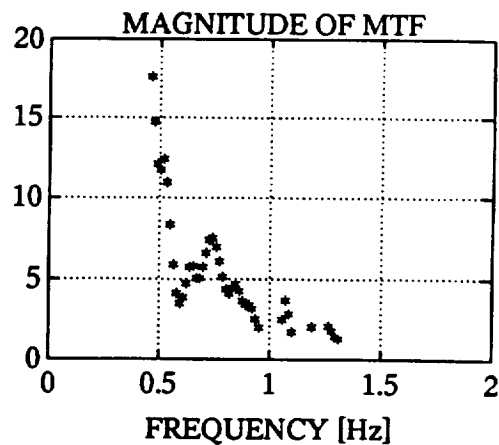
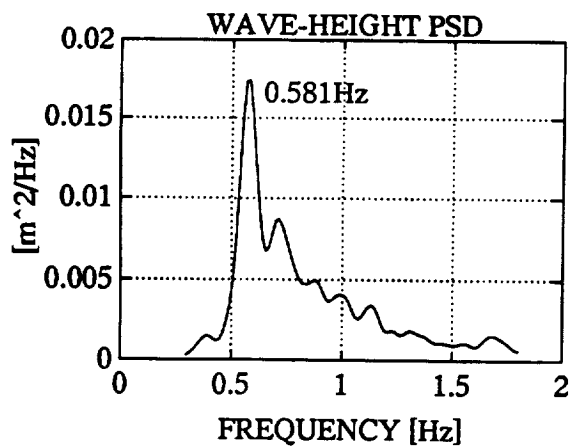
Aug. 4, 1989, Run Time : 17:19:12, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
WindSpeed : 4.75 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.2 deg C
Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



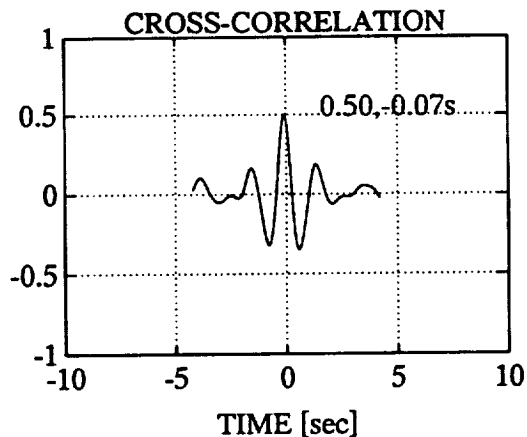
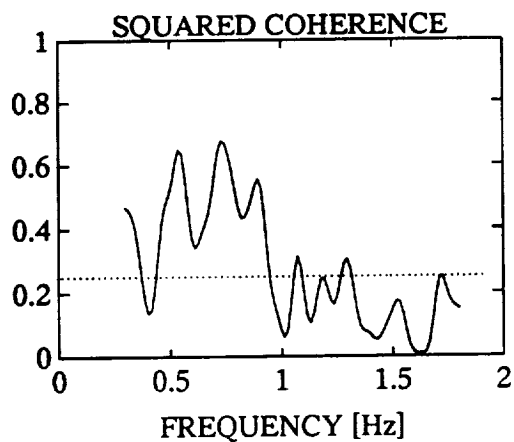
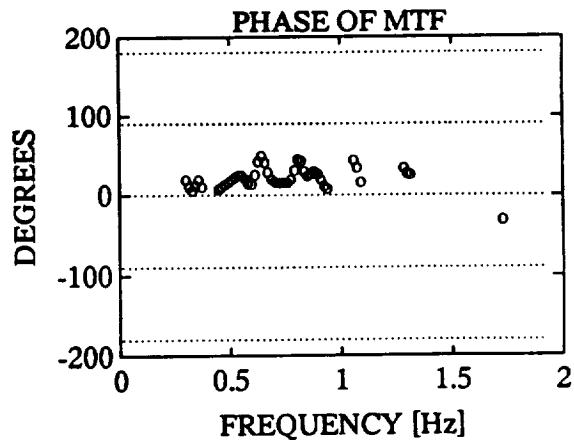
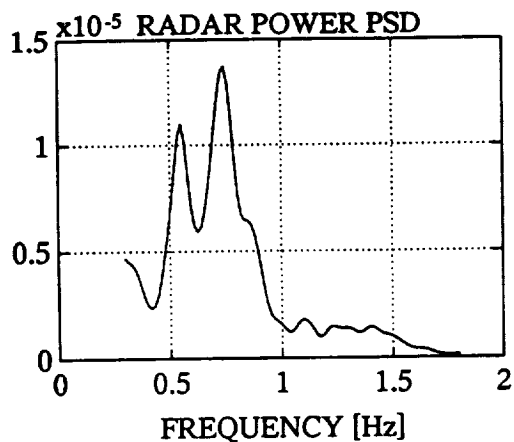
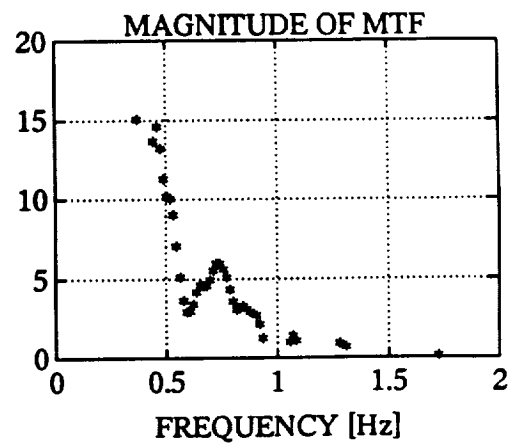
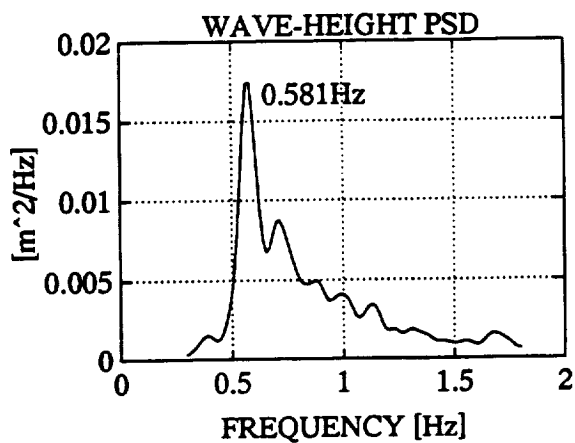
Aug. 4, 1989, Run Time : 17:24:45, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.33 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



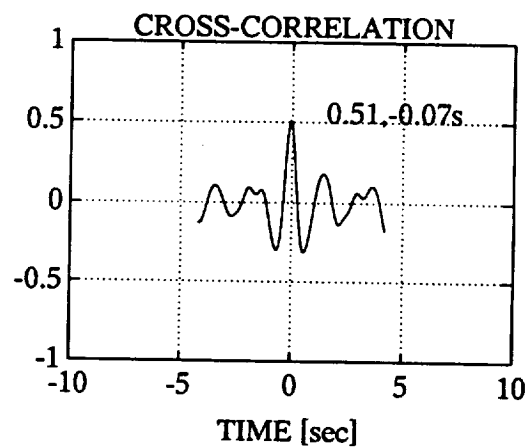
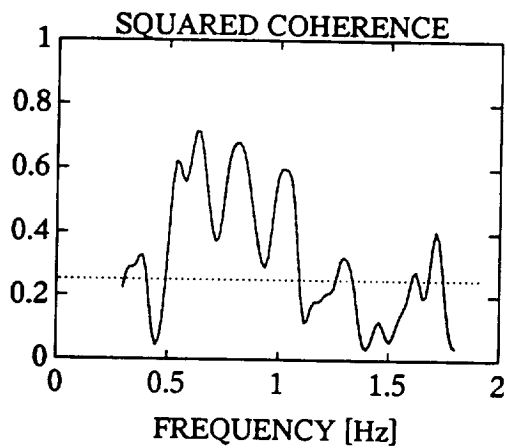
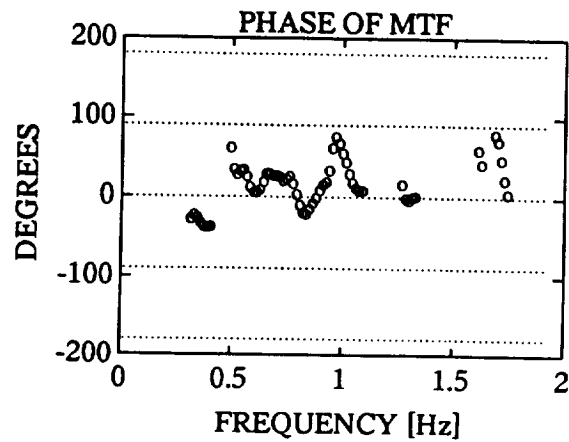
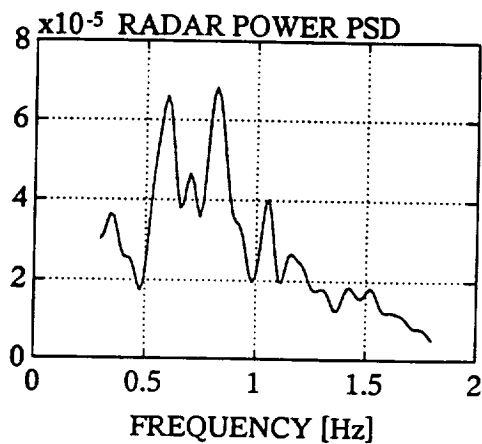
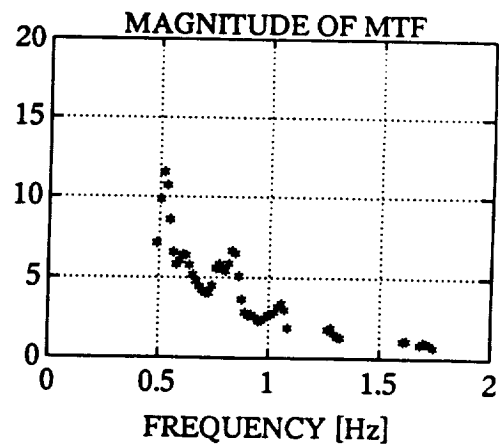
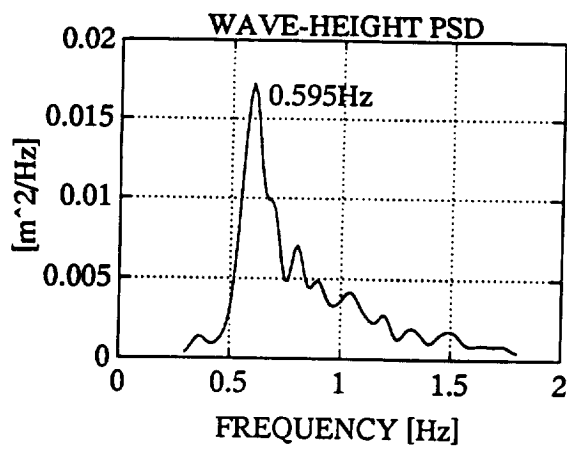
Aug. 4, 1989, Run Time : 17:24:45, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.33 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



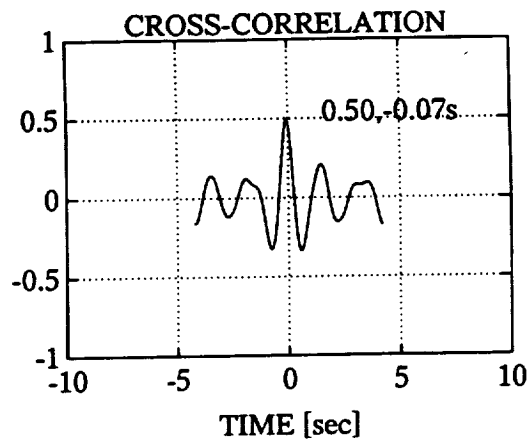
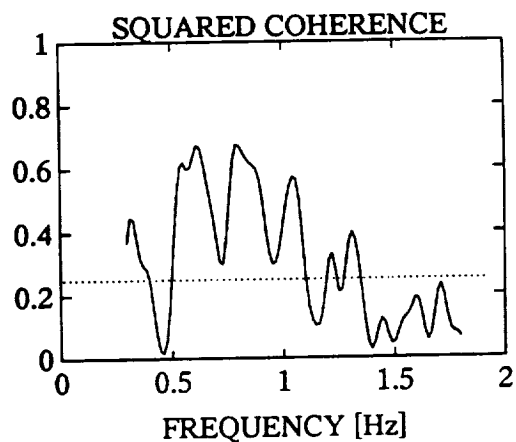
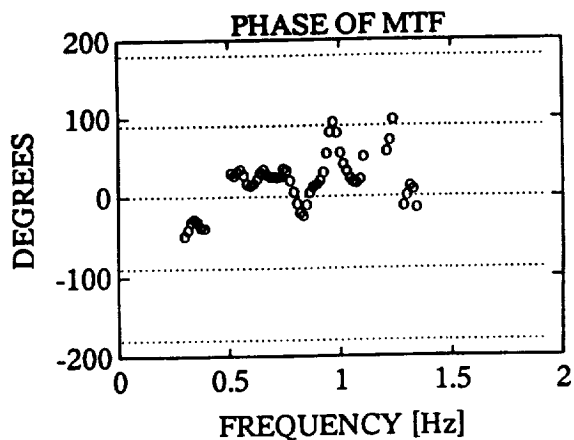
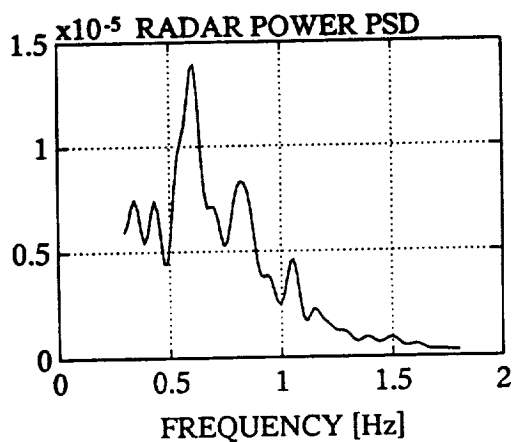
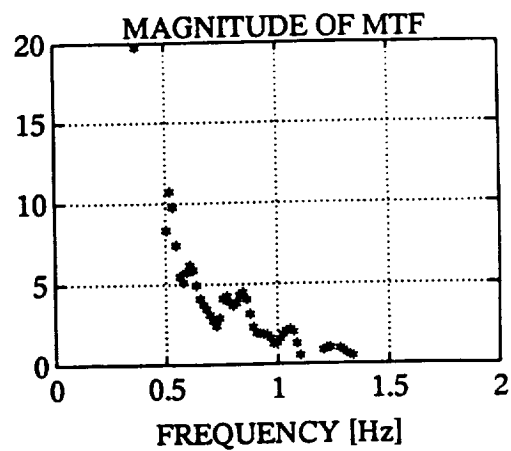
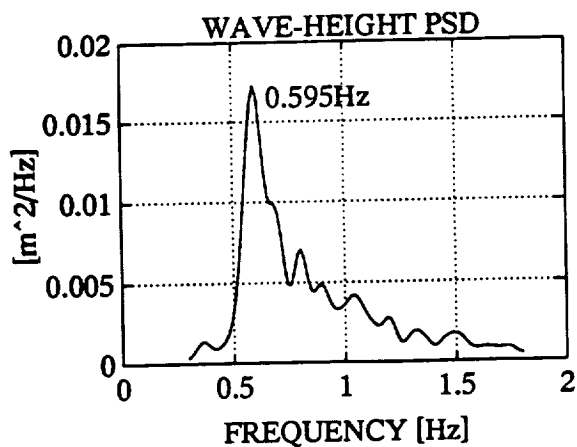
Aug. 4, 1989, Run Time : 17:30:30, Run # 17, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.23 m/s, Air Temp. : 23.0 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



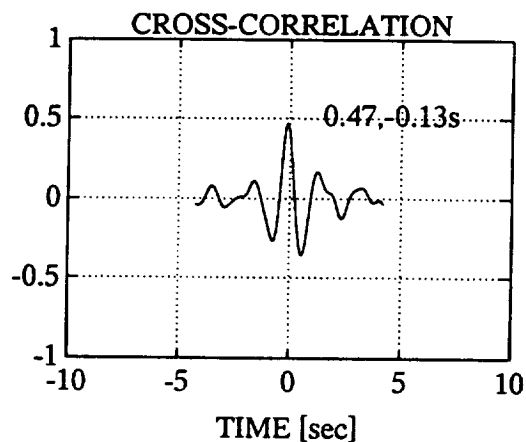
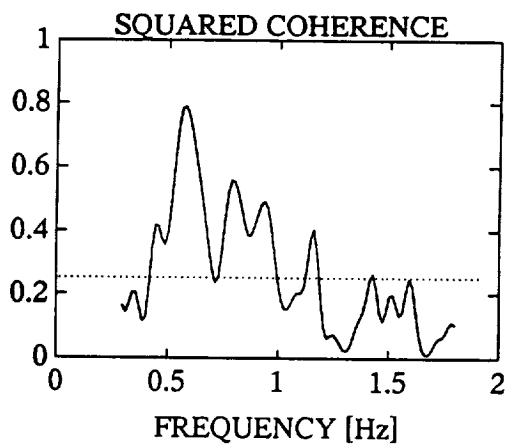
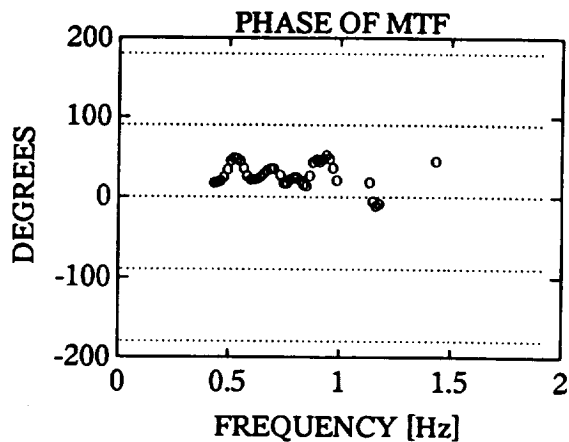
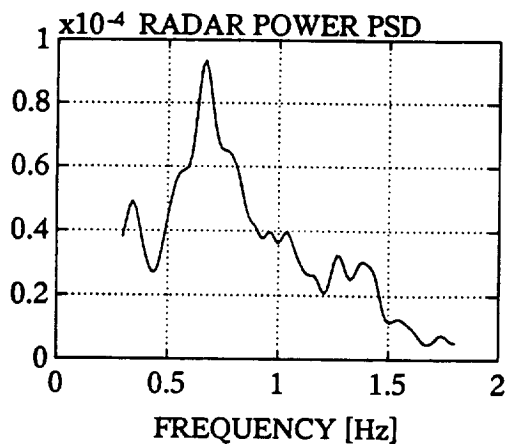
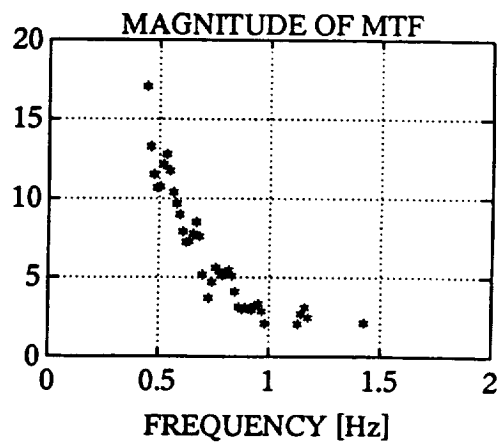
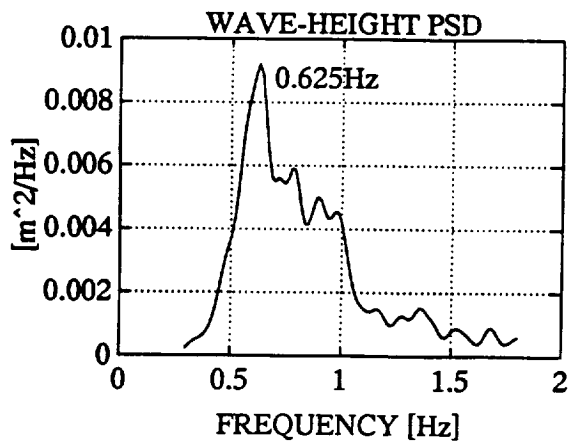
Aug. 4, 1989, Run Time : 17:30:30, Run # 17, X Band, VV Polarization, 34.0 deg. Incidence
WindSpeed : 5.23 m/s, Air Temp. : 23.0 deg C, Water Temp. : 22.1 deg C
Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



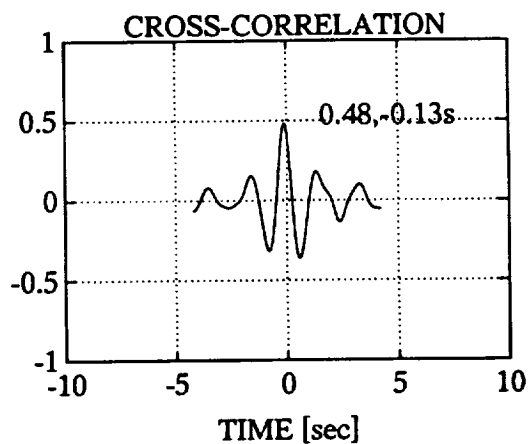
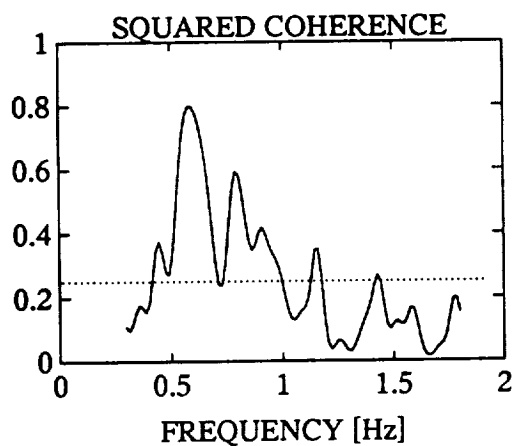
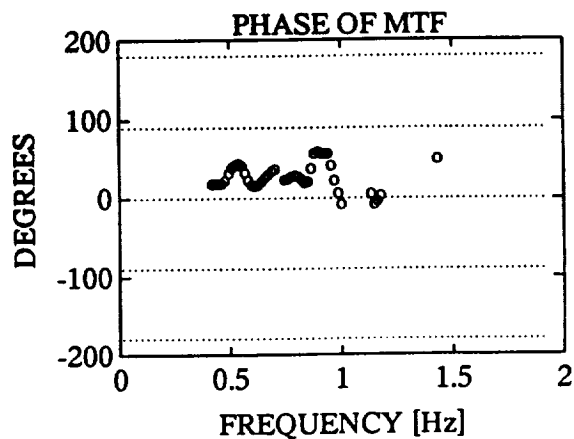
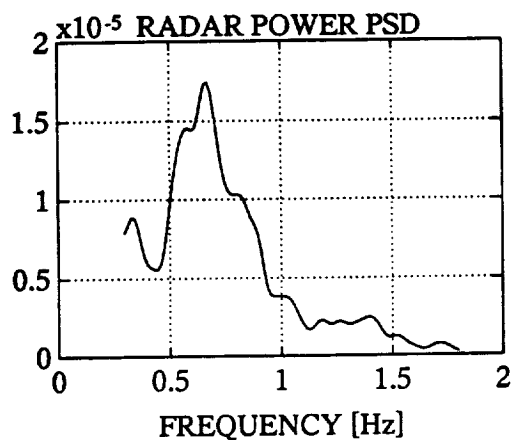
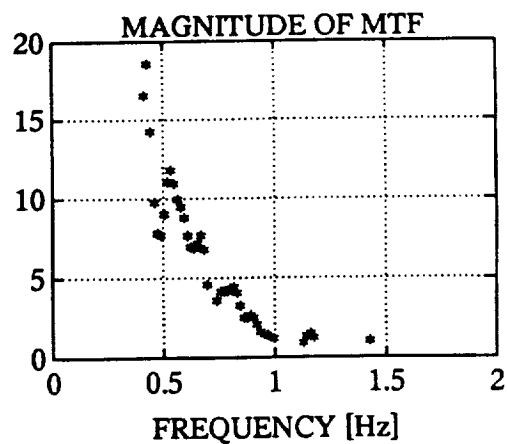
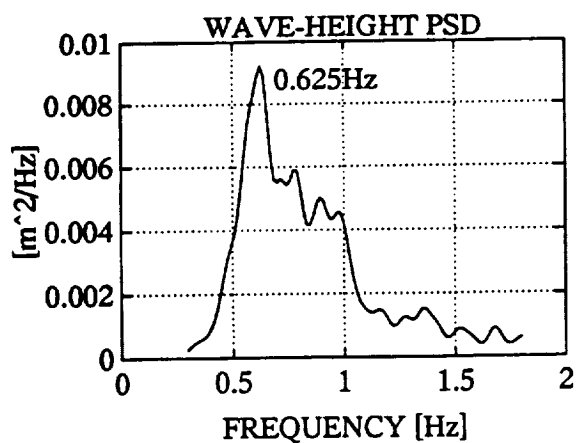
Aug. 4, 1989, Run Time : 17:35:50, Run # 18, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



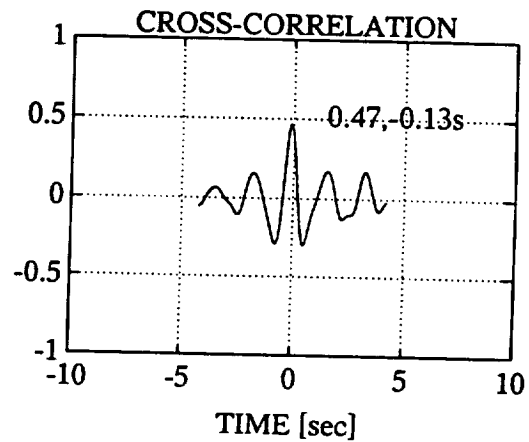
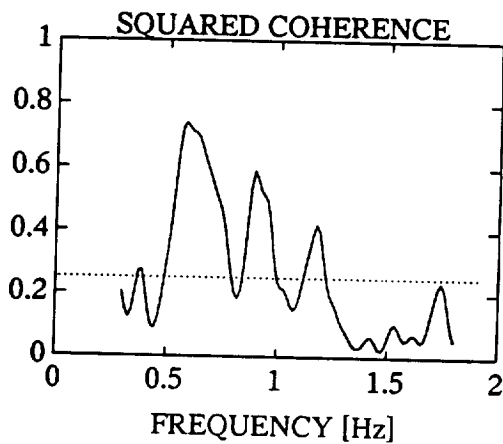
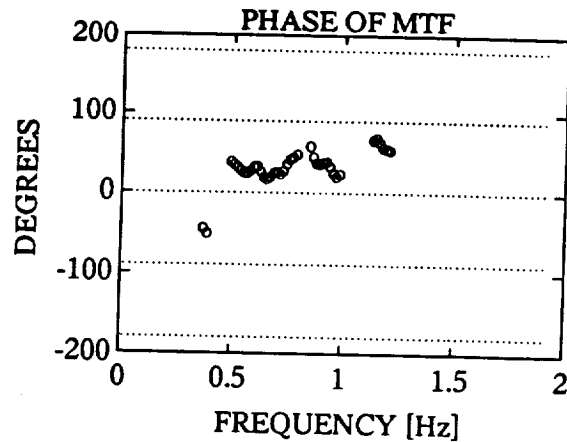
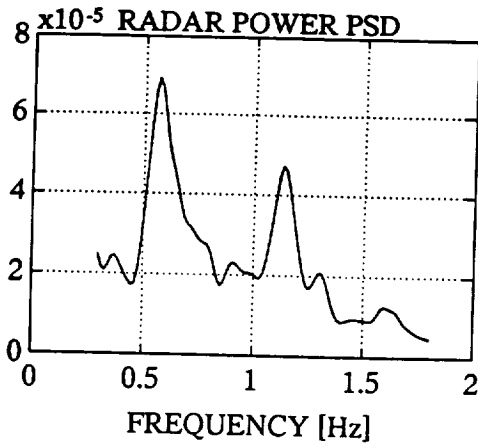
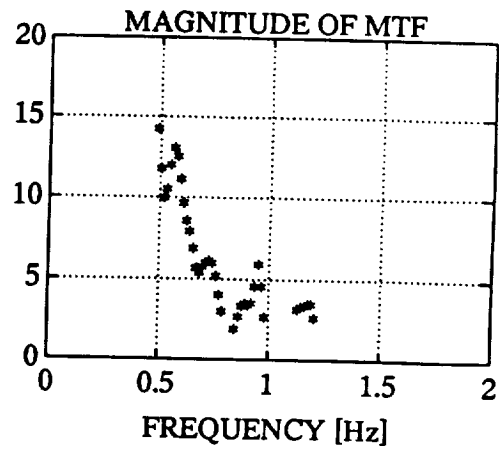
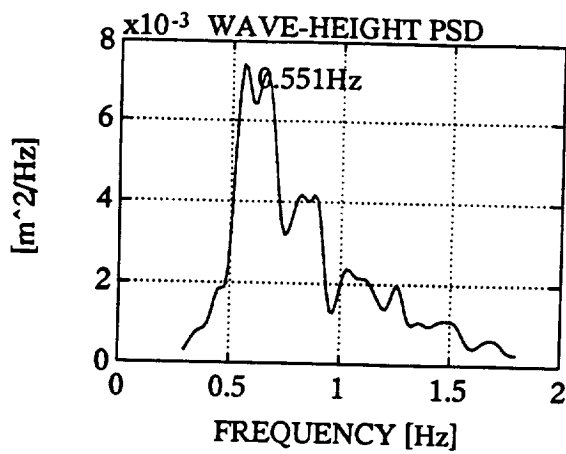
Aug. 4, 1989, Run Time : 17:35:50, Run # 18, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



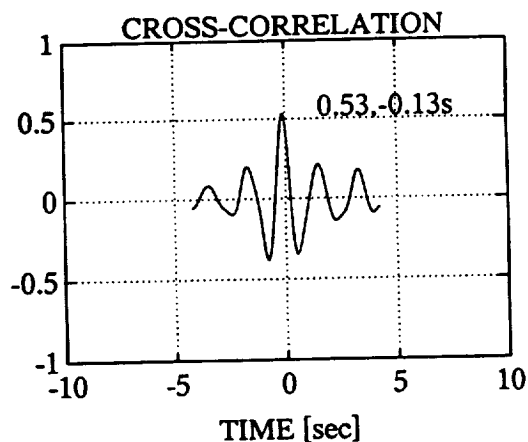
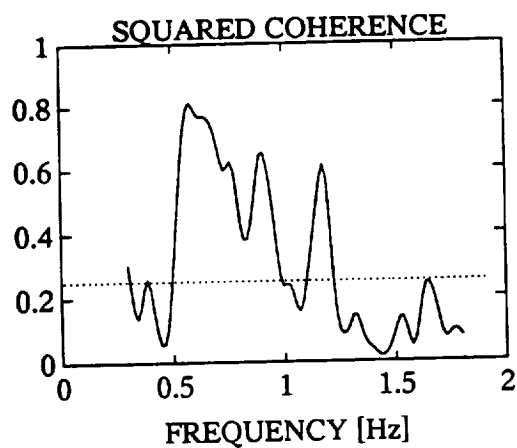
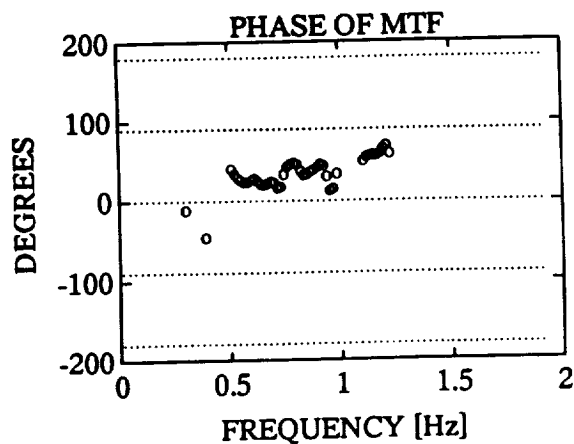
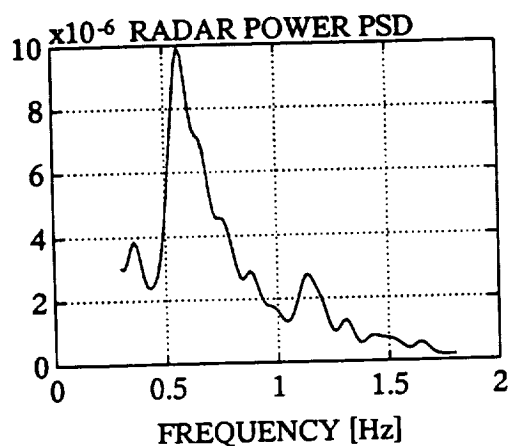
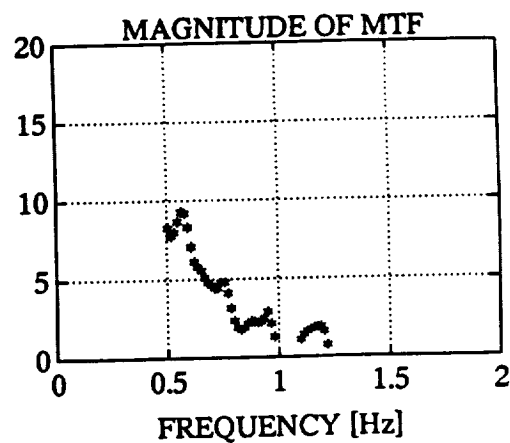
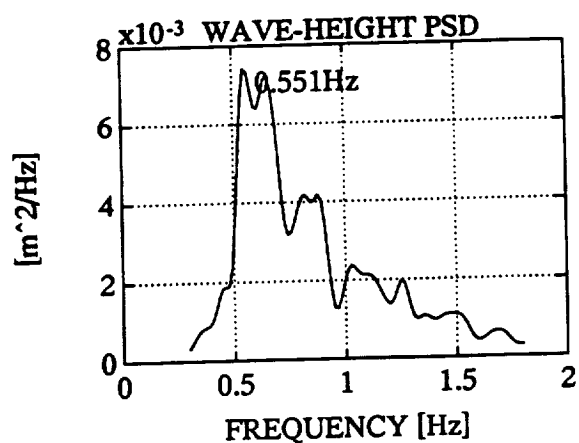
Aug. 4, 1989, Run Time : 17:41:25, Run # 19, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.63 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



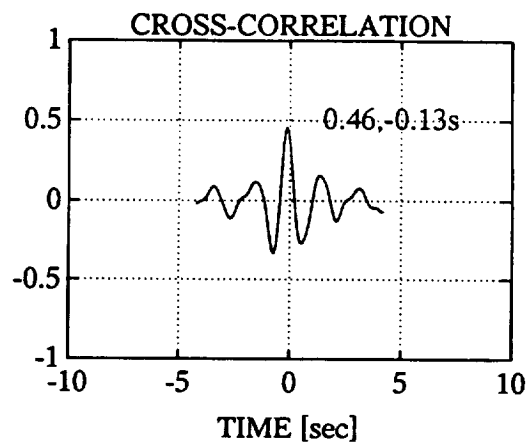
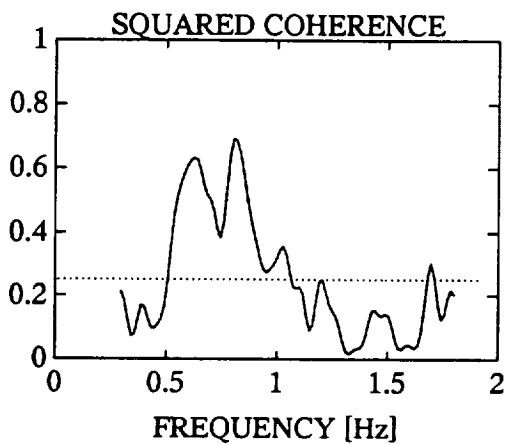
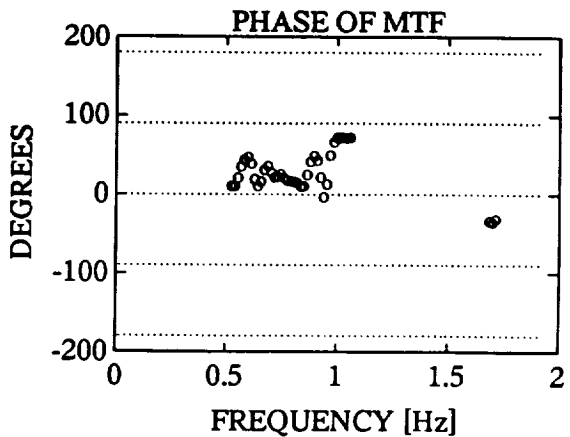
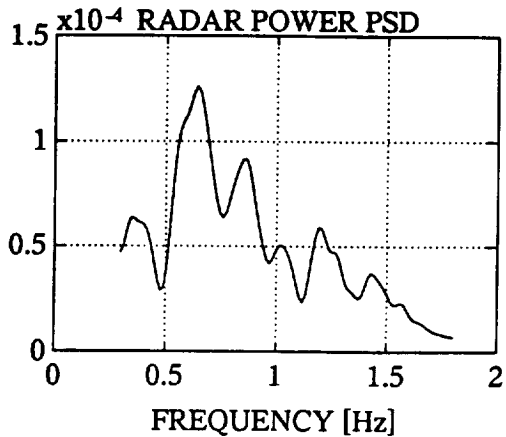
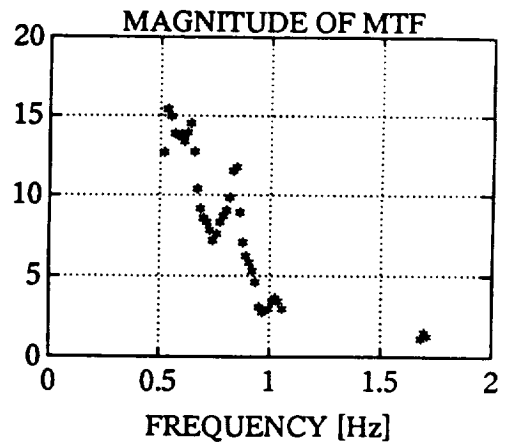
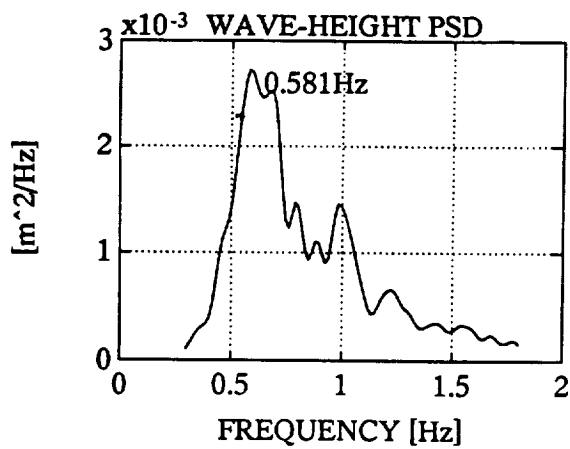
Aug. 4, 1989, Run Time : 17:41:25, Run # 19, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.63 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



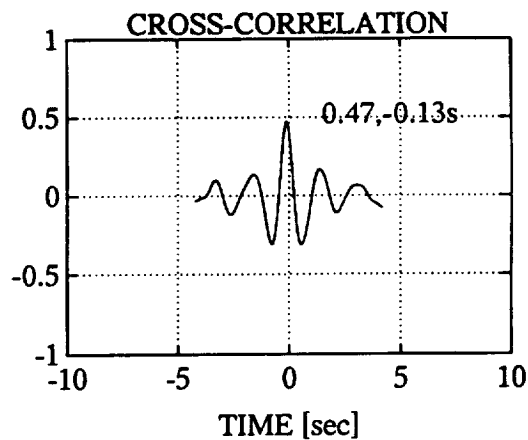
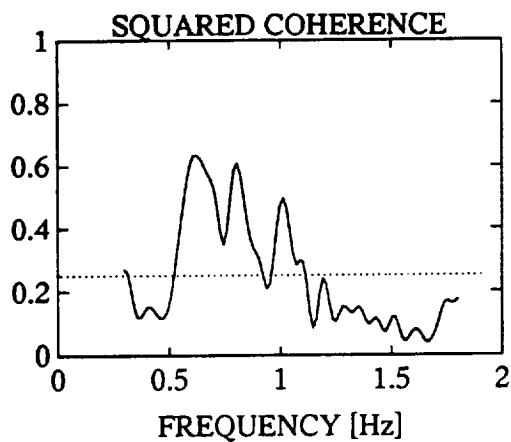
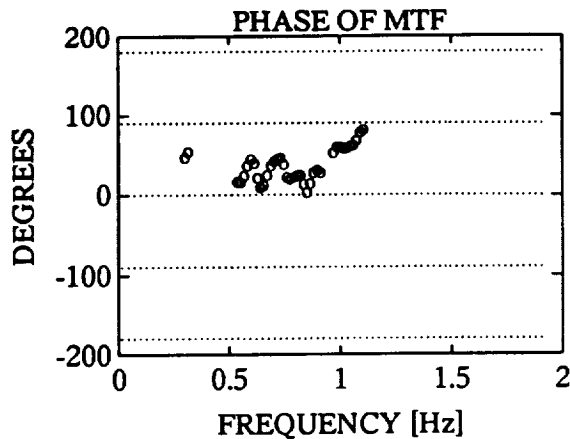
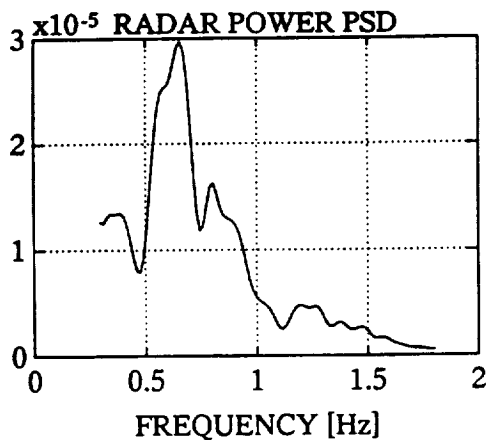
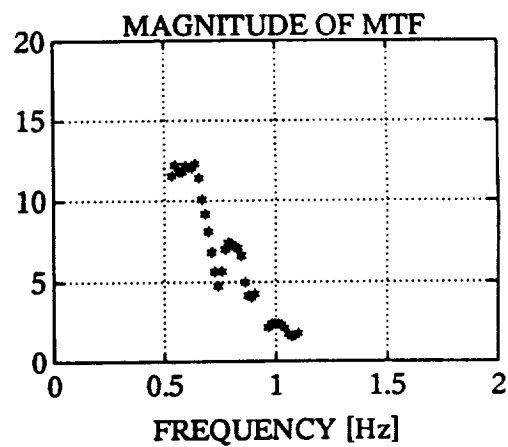
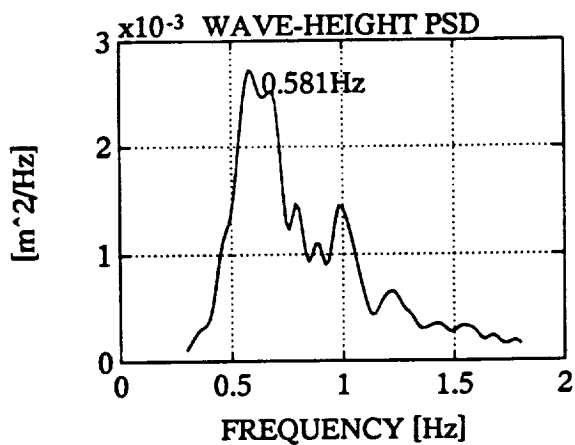
Aug. 4, 1989, Run Time : 17:46:58, Run # 20, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



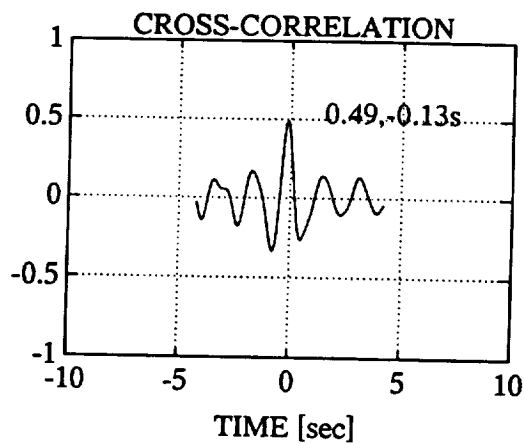
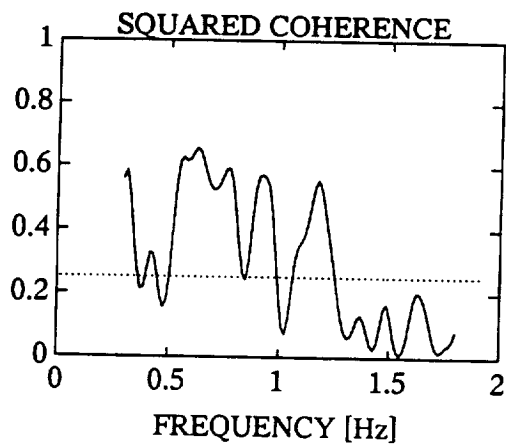
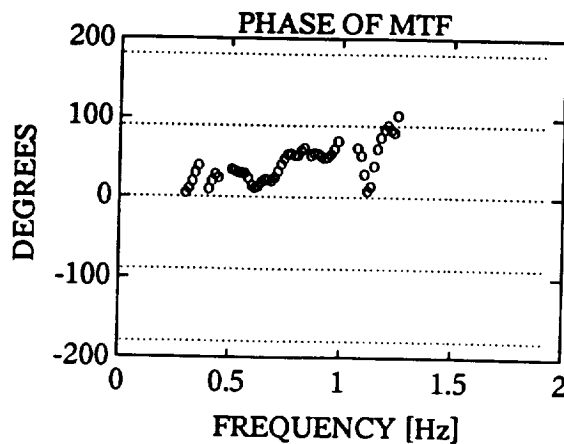
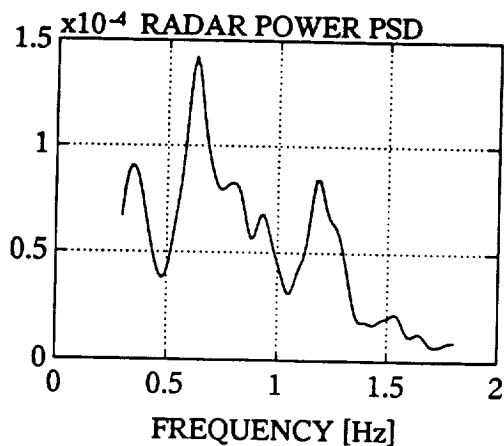
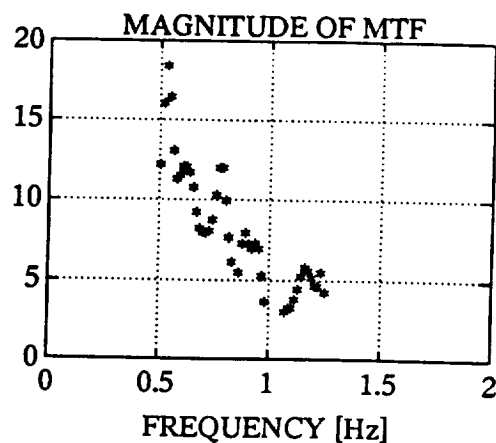
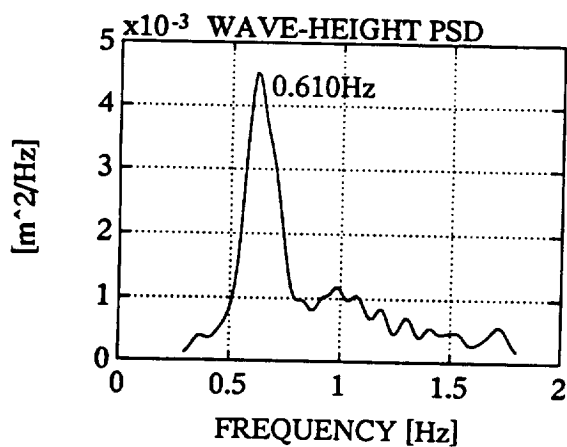
Aug. 4, 1989, Run Time : 17:46:58, Run # 20, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.98 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



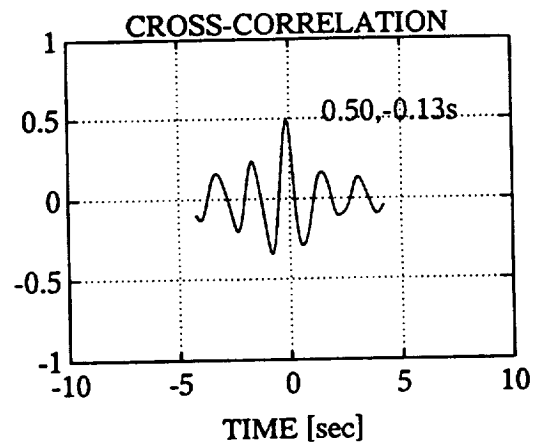
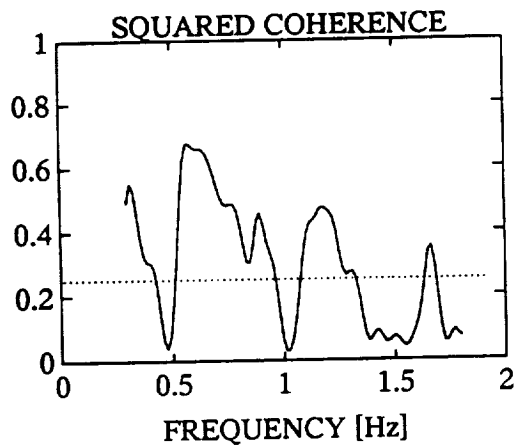
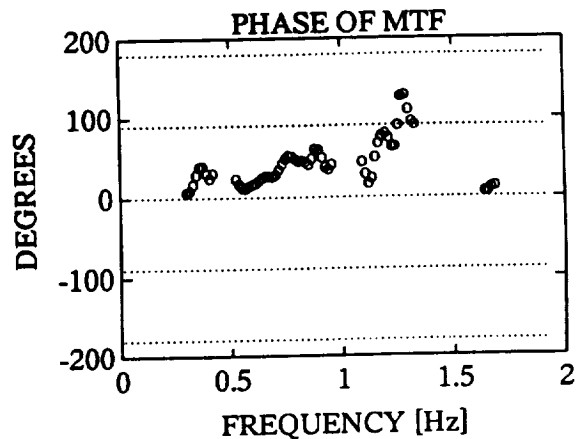
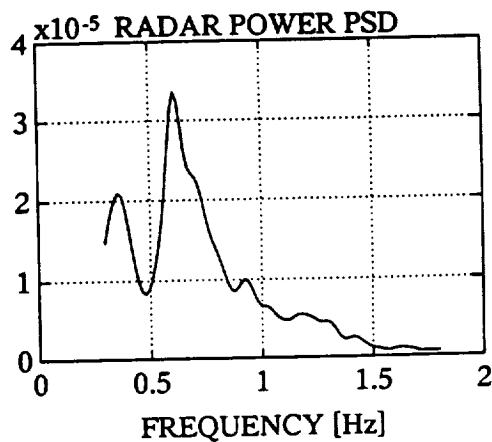
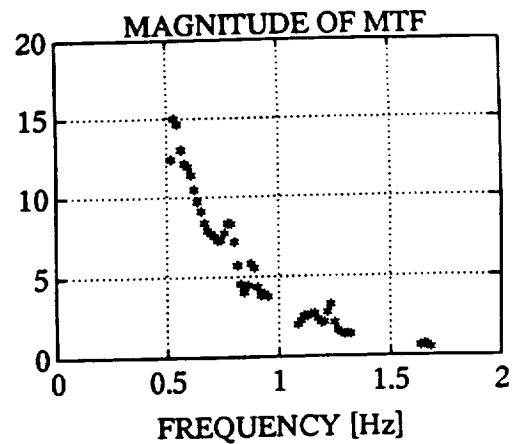
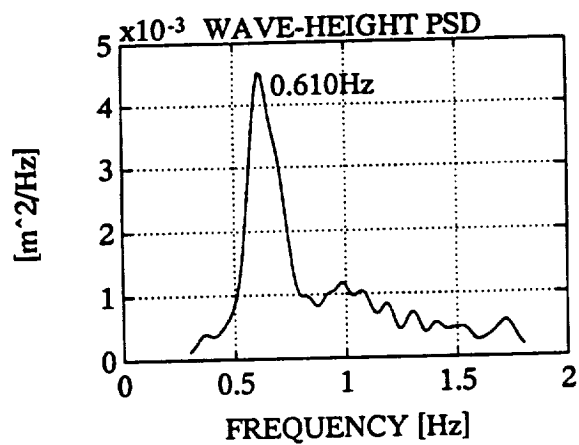
Aug. 4, 1989, Run Time : 17:53:50, Run # 21, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.75 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



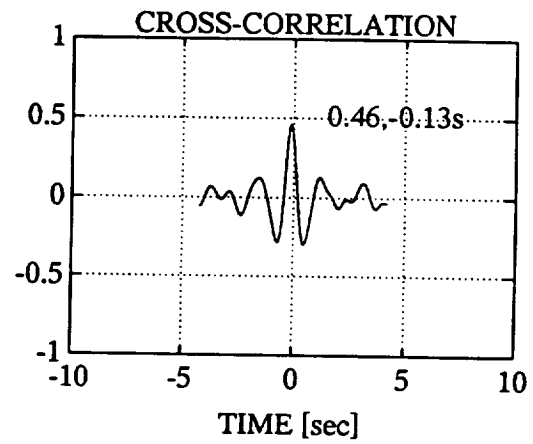
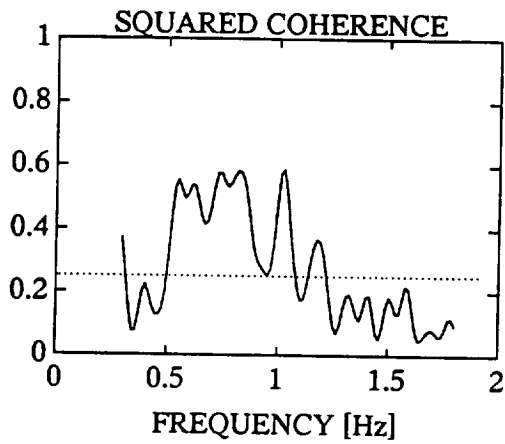
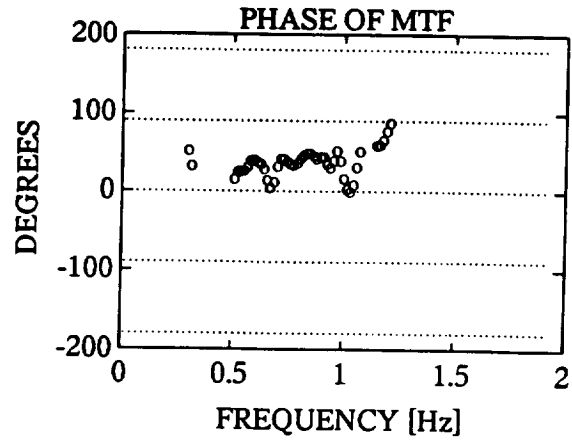
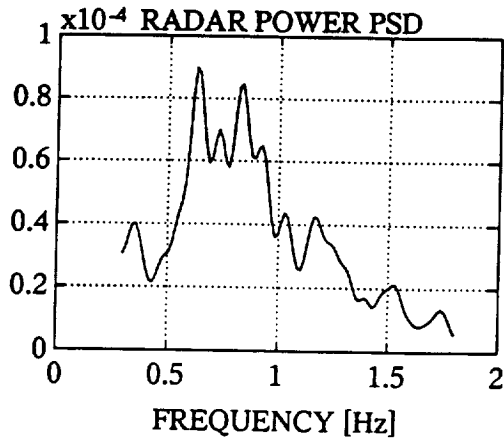
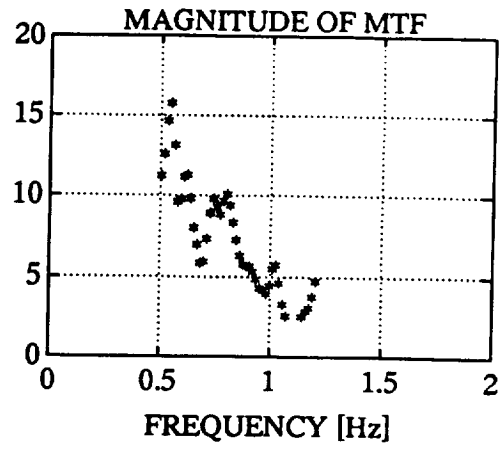
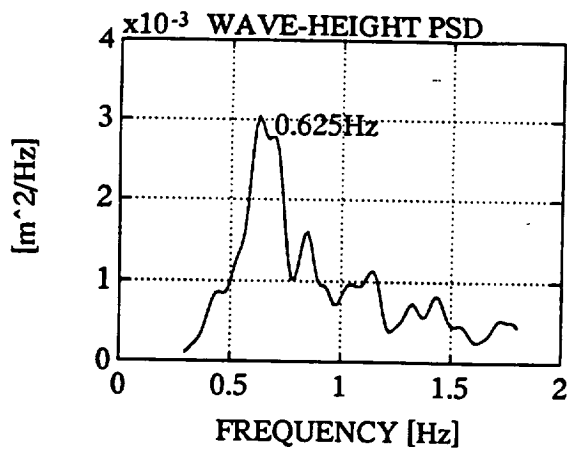
Aug. 4, 1989, Run Time : 17:53:50, Run # 21, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.75 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



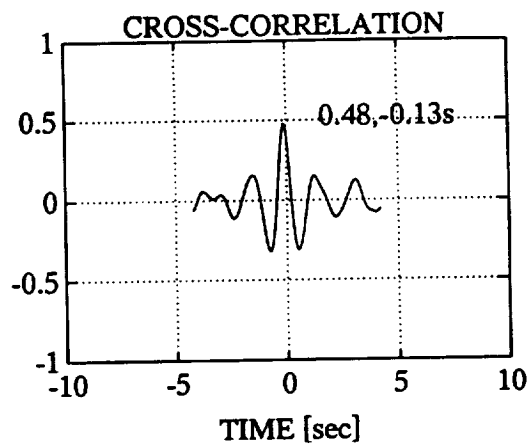
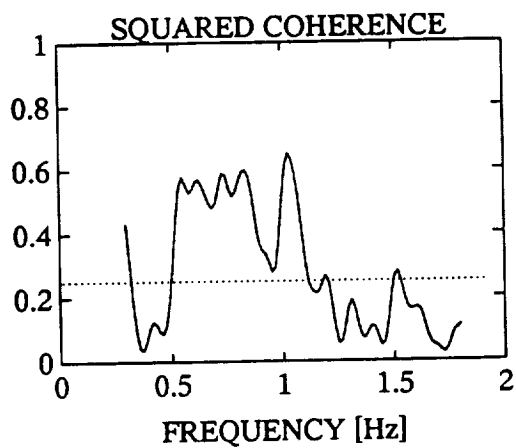
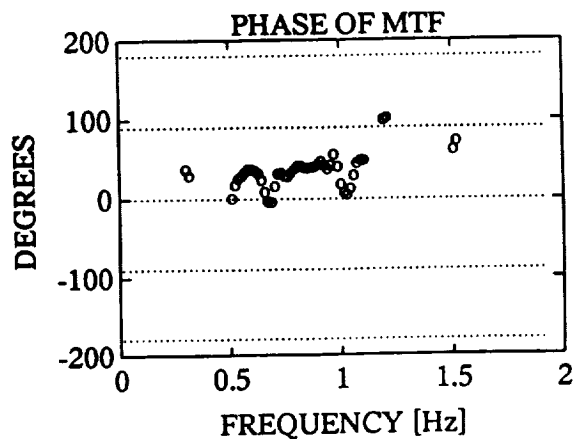
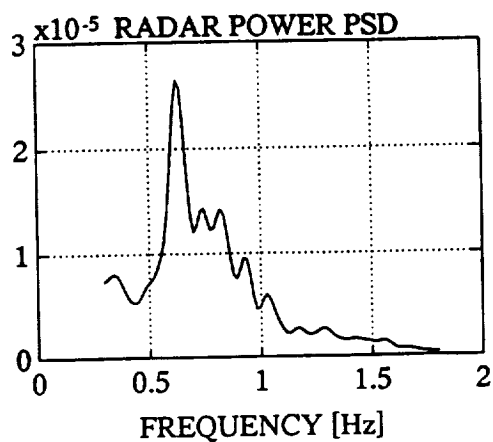
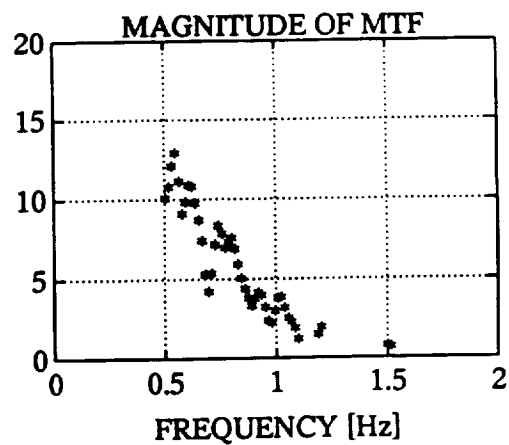
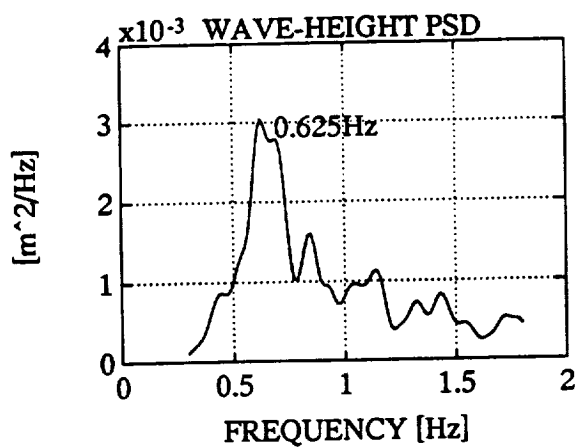
Aug. 4, 1989, Run Time : 18: 5:40, Run # 23, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.61 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



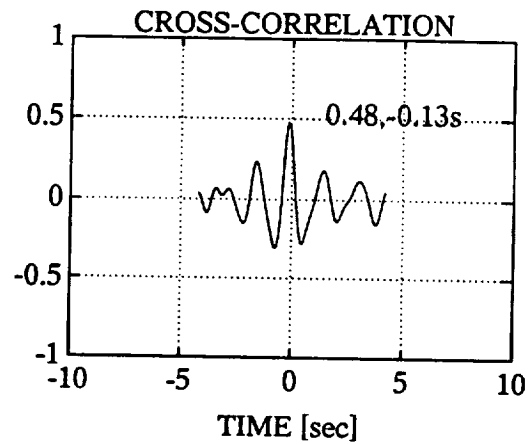
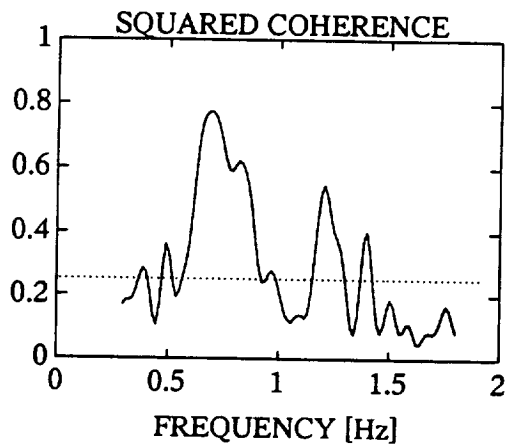
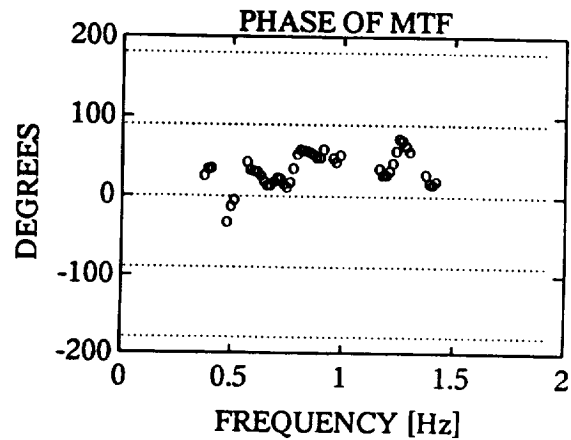
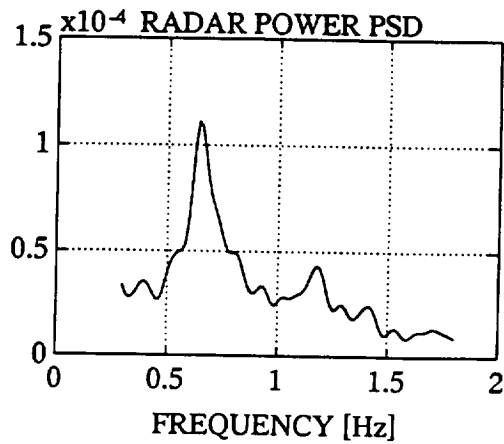
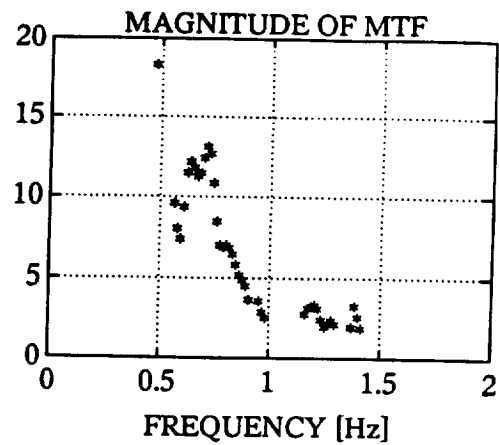
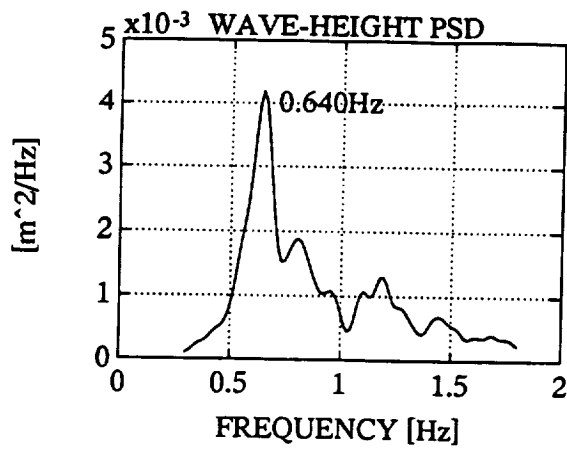
Aug. 4, 1989, Run Time : 18: 5:40, Run # 23, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.61 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



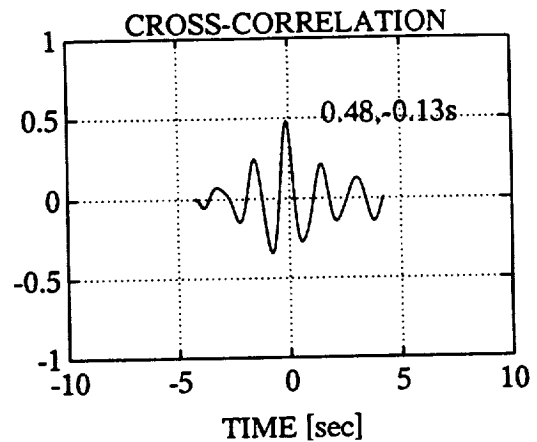
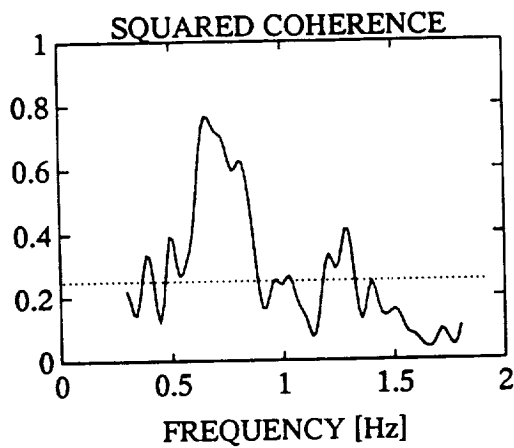
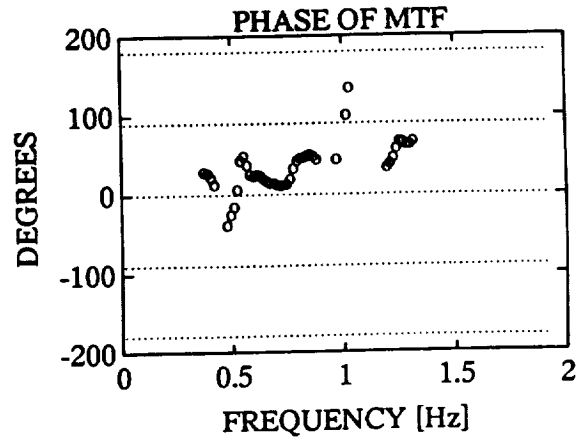
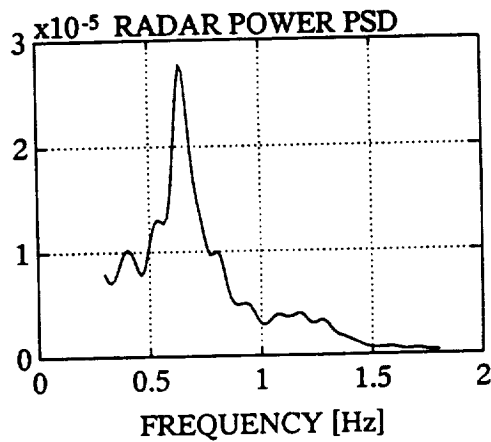
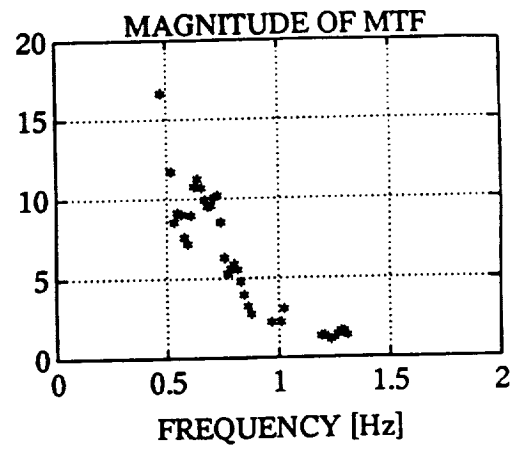
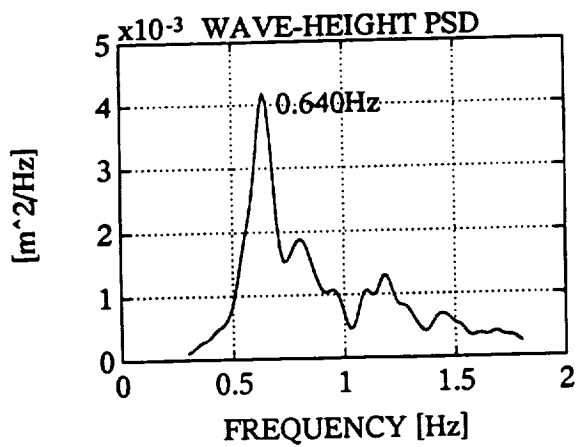
Aug. 4, 1989, Run Time : 18:11: 2, Run # 24, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.26 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



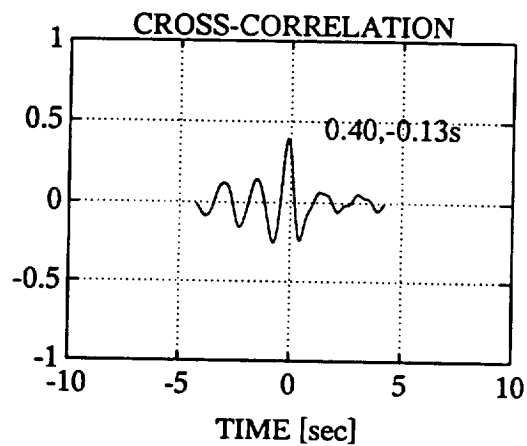
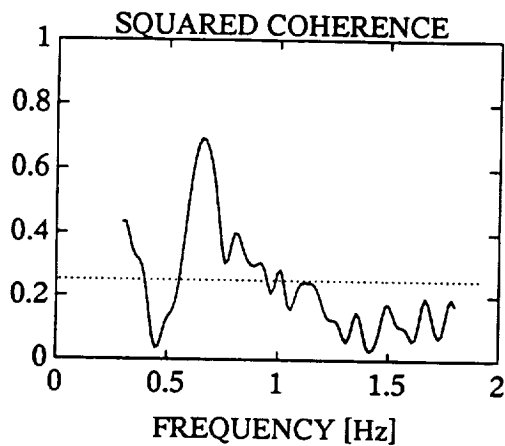
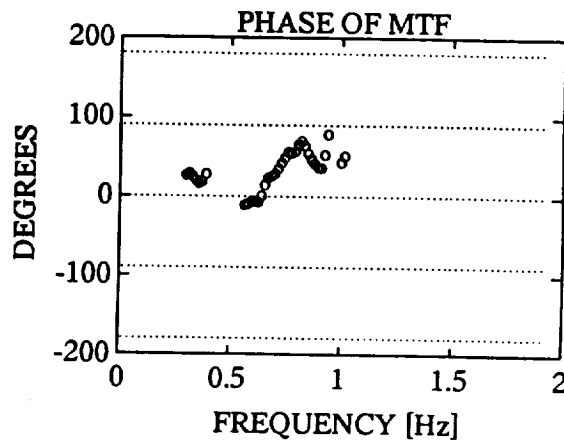
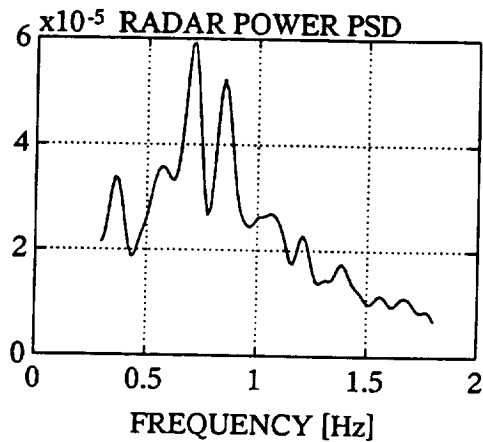
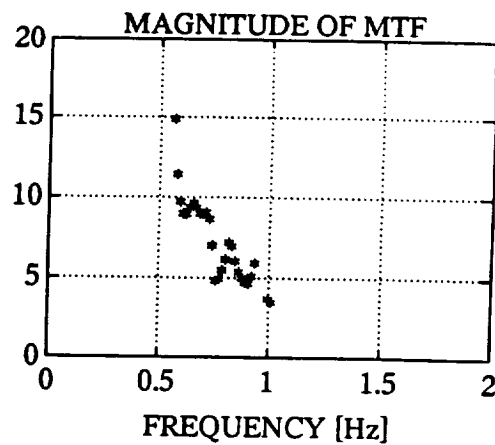
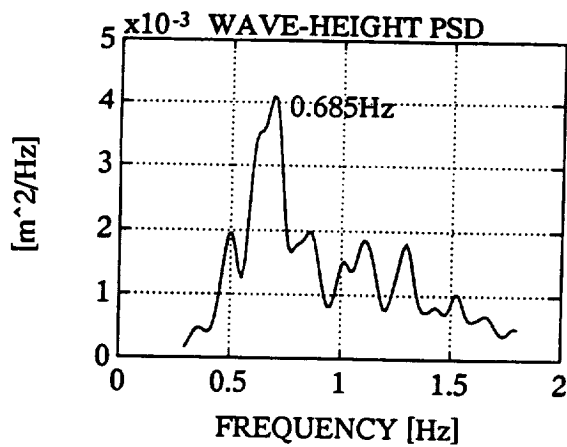
Aug. 4, 1989, Run Time : 18:11: 2, Run # 24, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.26 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



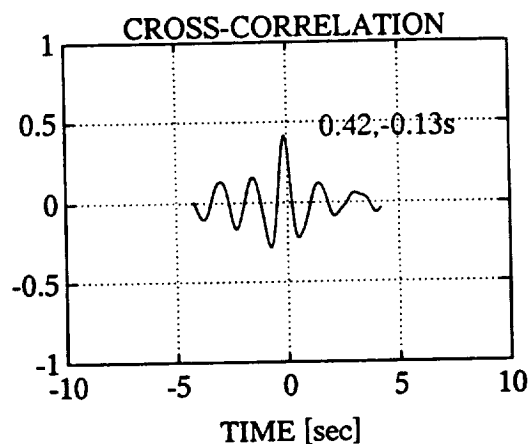
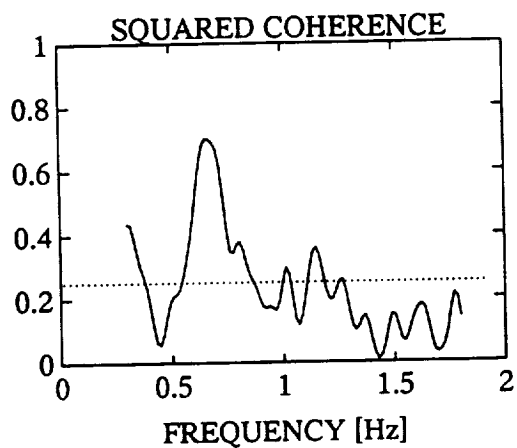
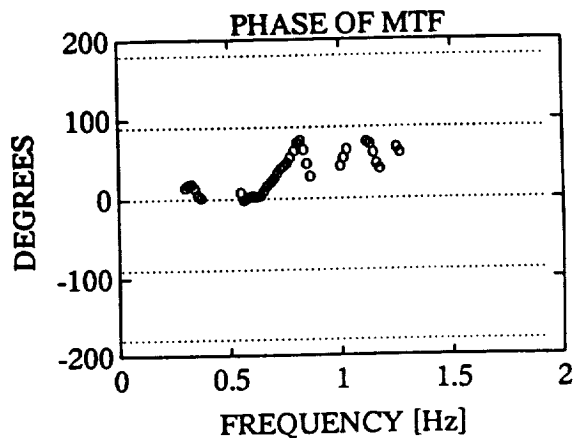
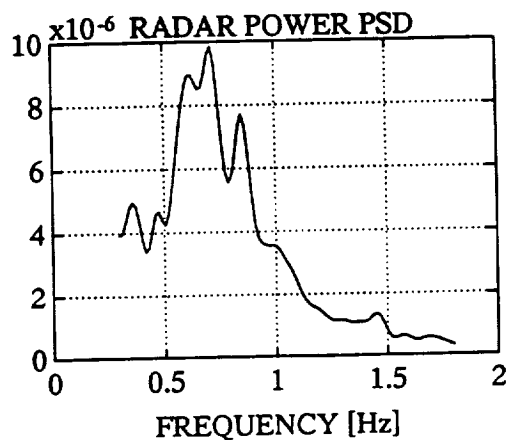
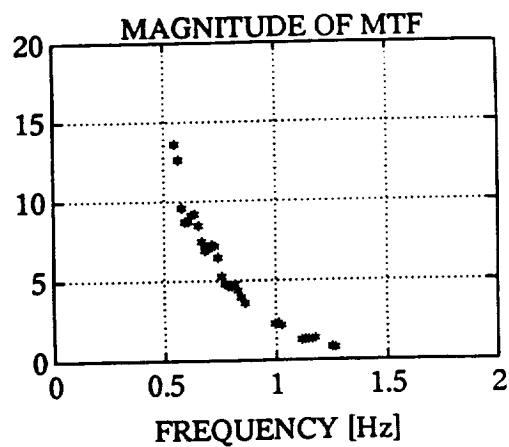
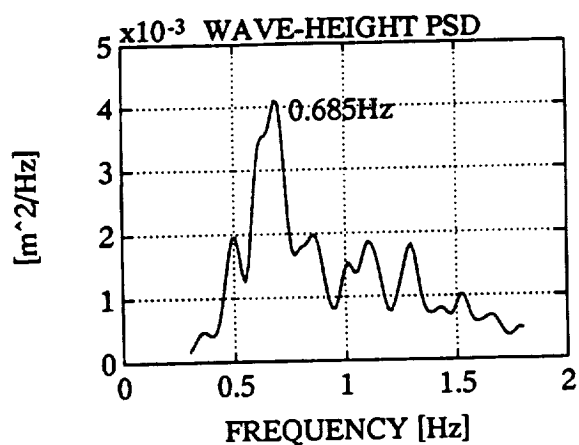
Aug. 4, 1989, Run Time : 18:16:50, Run # 25, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.29 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



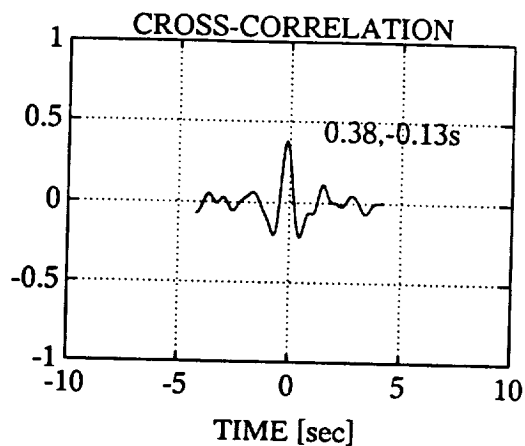
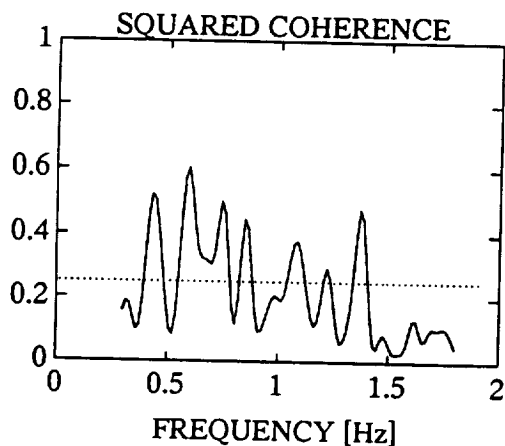
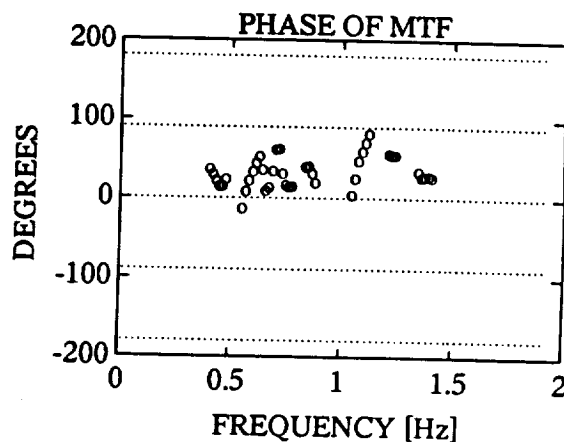
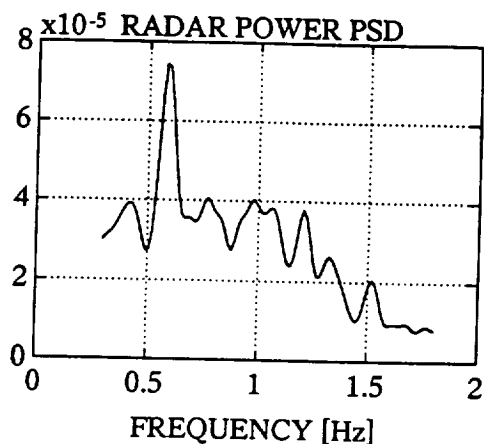
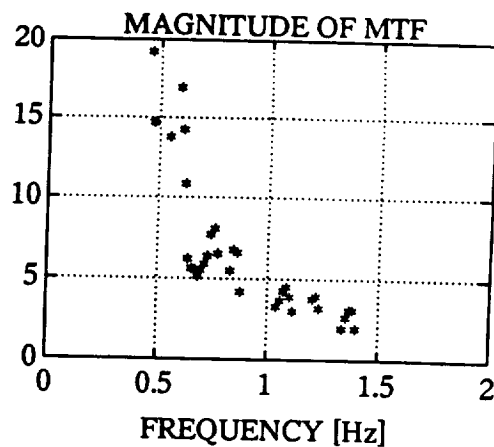
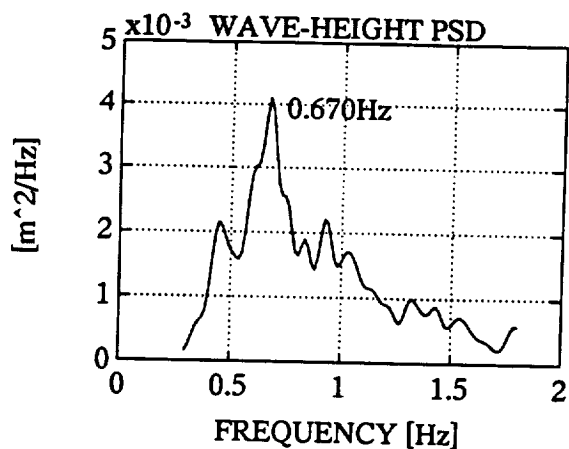
Aug. 4, 1989, Run Time : 18:16:50, Run # 25, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 4.29 m/s, Air Temp. : 23.4 deg C, Water Temp. : 22.1 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



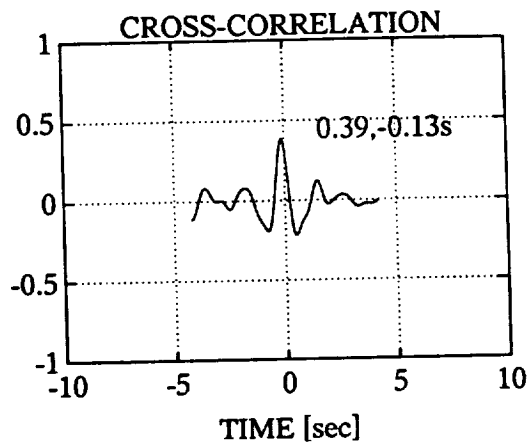
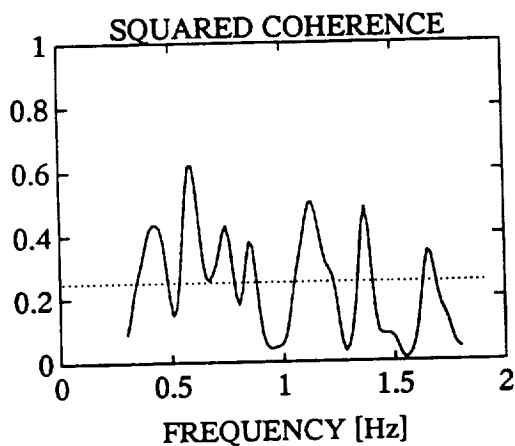
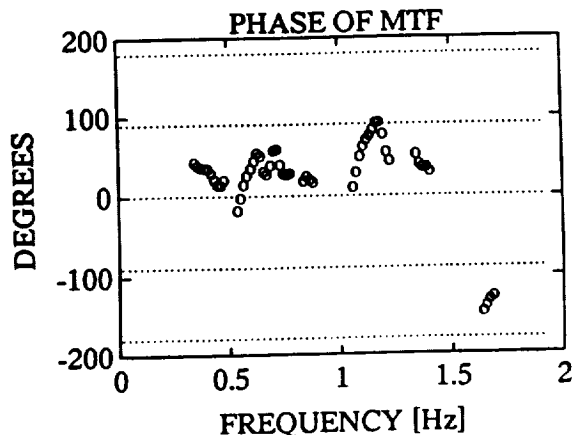
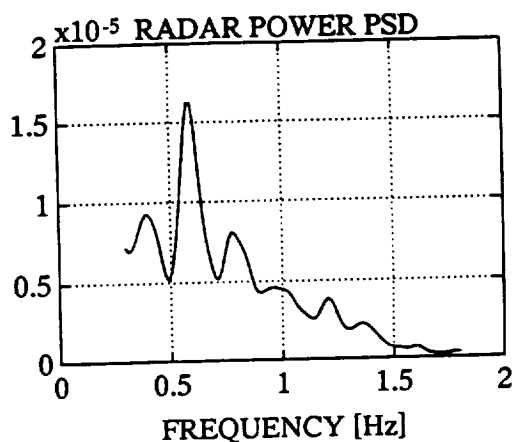
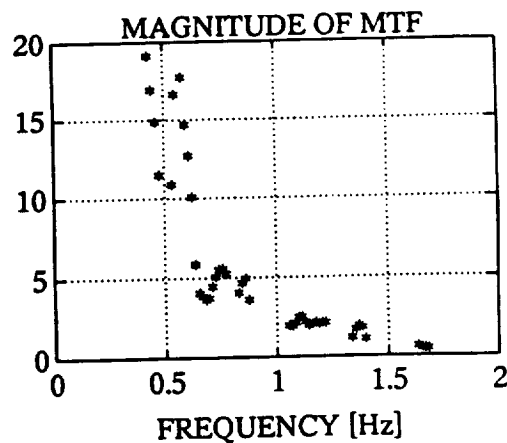
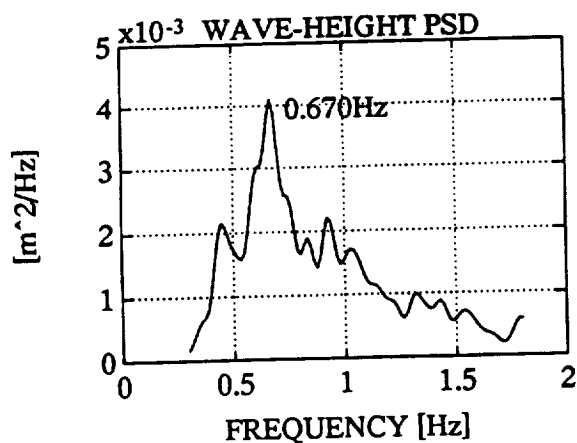
Aug. 4, 1989, Run Time : 18:29:15, Run # 27, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.17 m/s, Air Temp. : 23.0 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



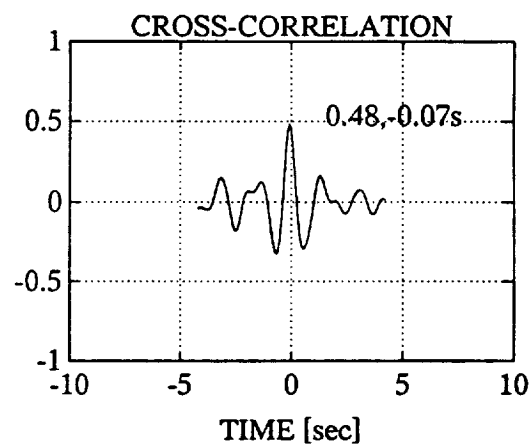
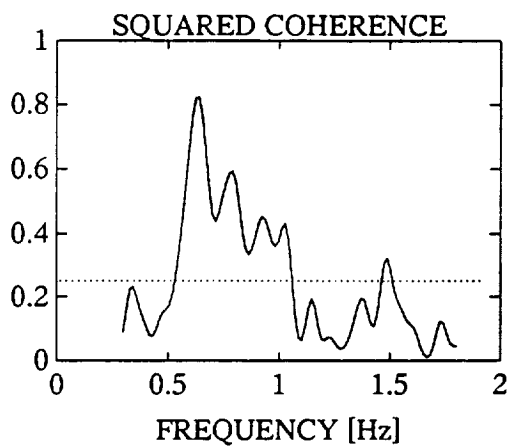
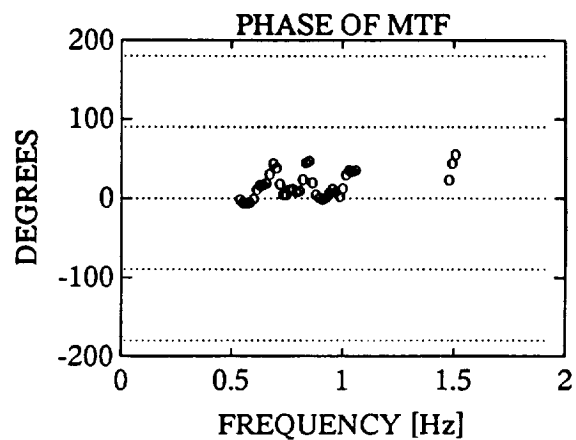
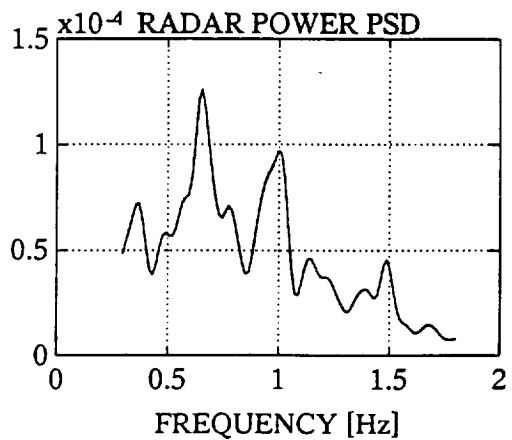
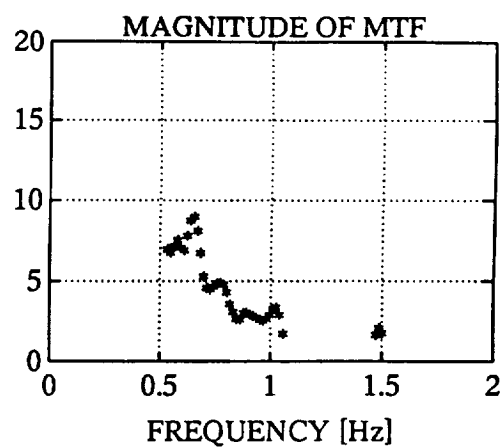
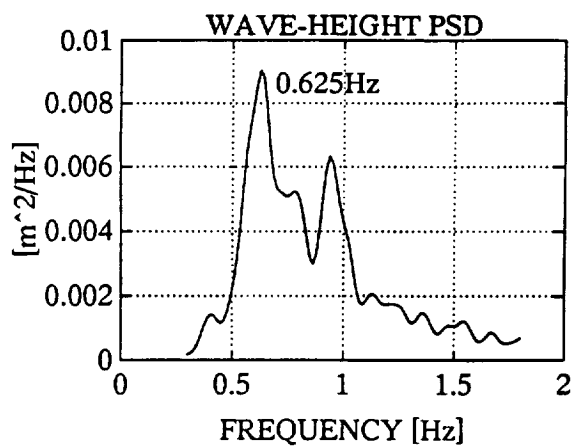
Aug. 4, 1989, Run Time : 18:29:15, Run # 27, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.17 m/s, Air Temp. : 23.0 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



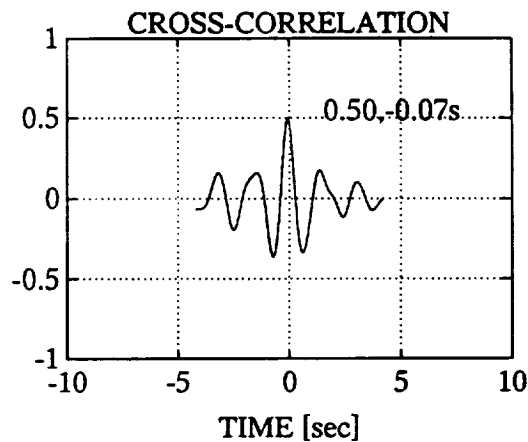
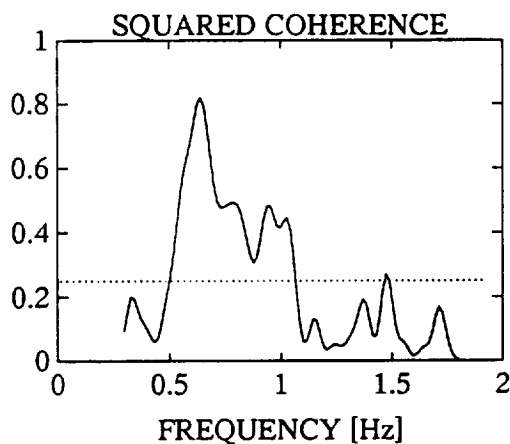
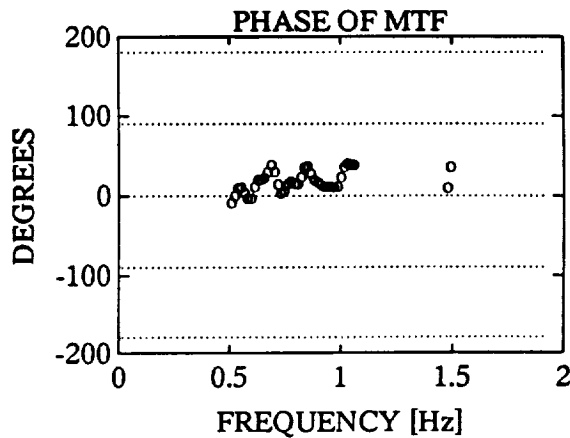
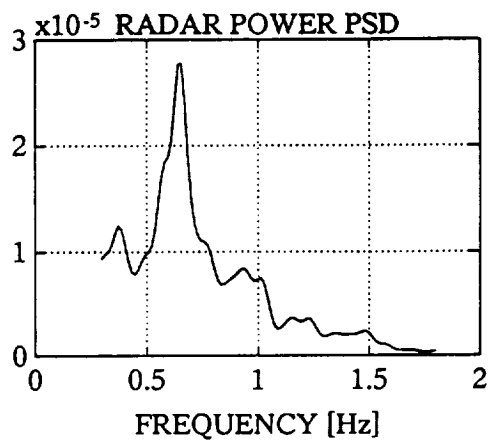
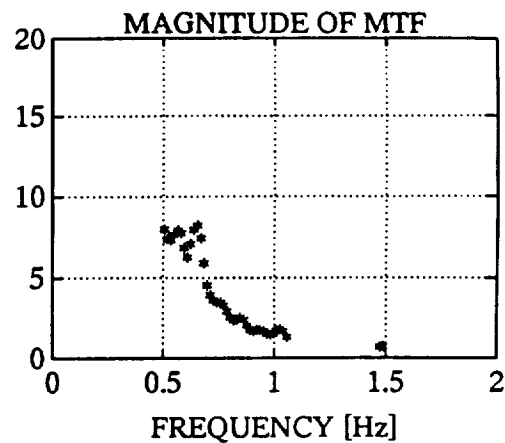
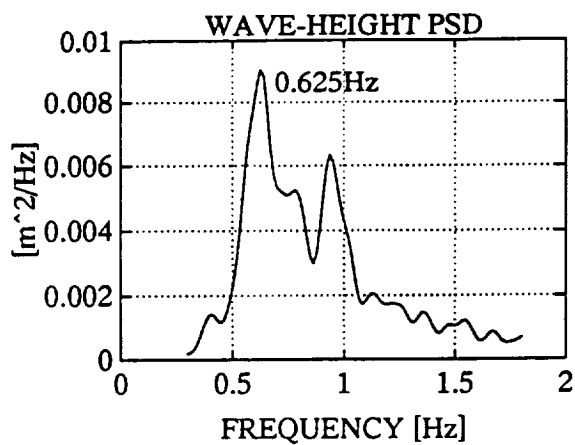
Aug. 4, 1989, Run Time : 18:35:25, Run # 28, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.89 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



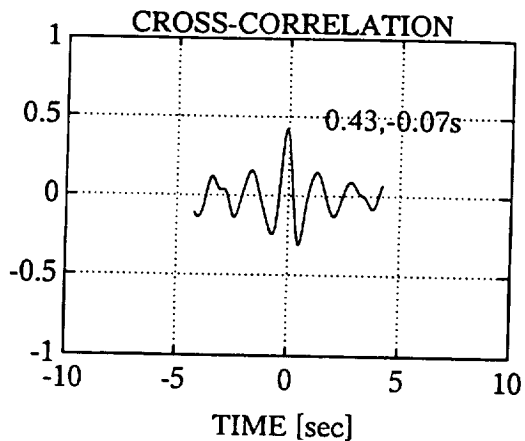
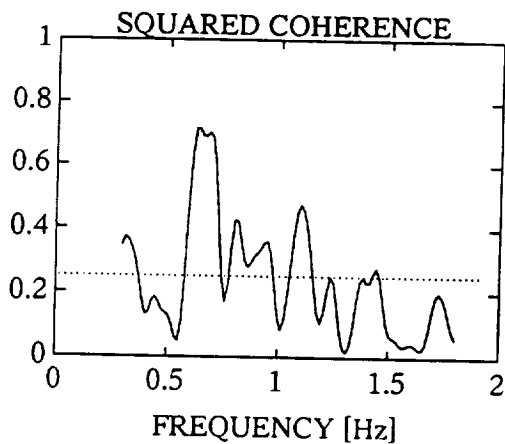
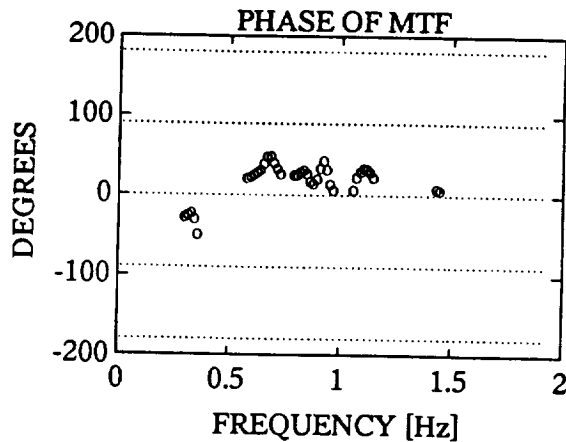
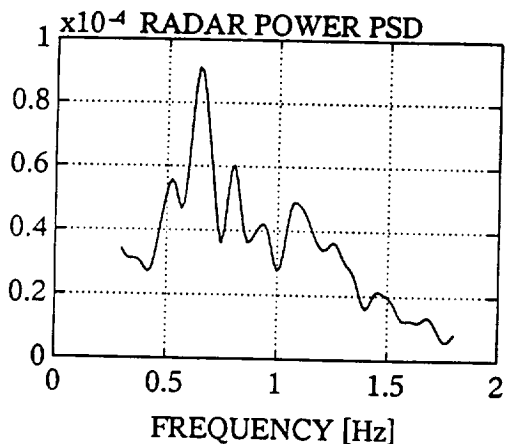
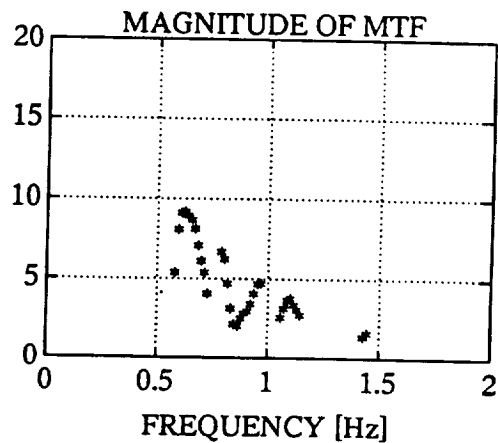
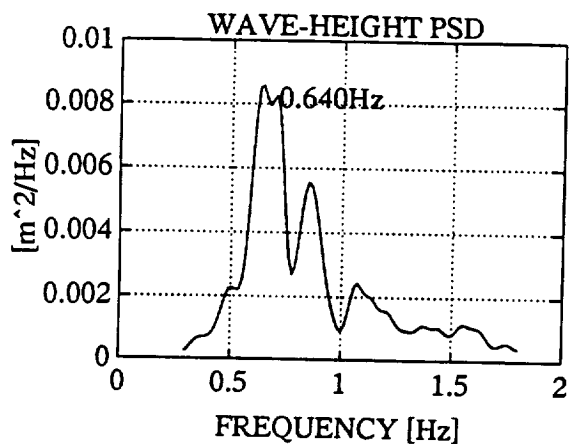
Aug. 4, 1989, Run Time : 18:35:25, Run # 28, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 3.89 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



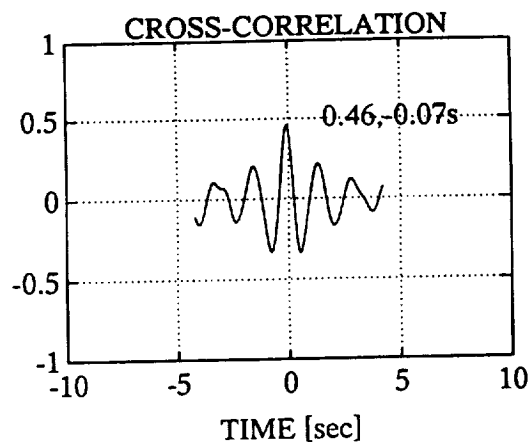
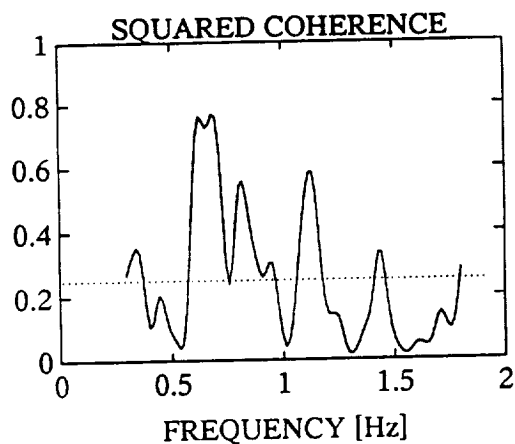
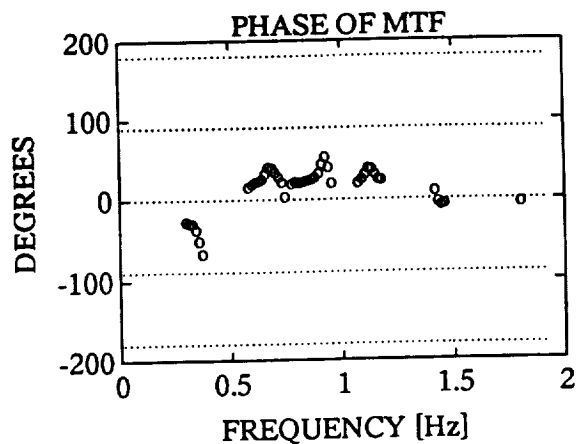
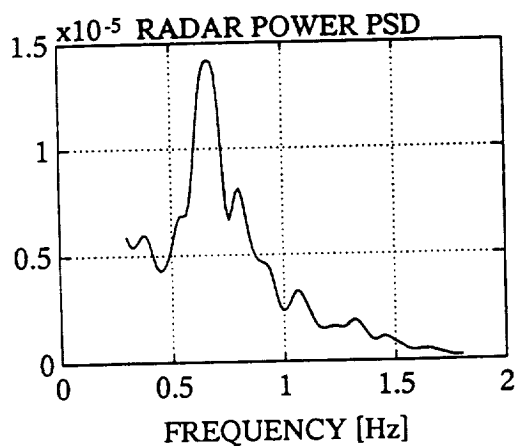
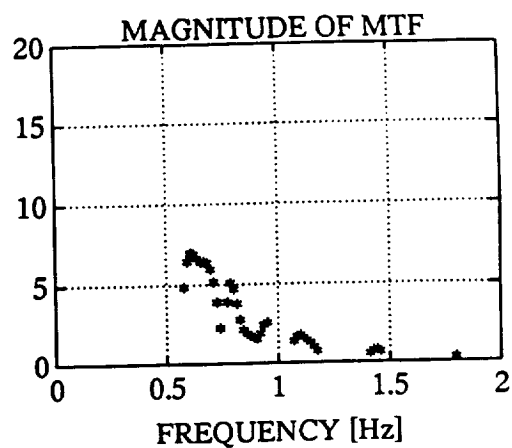
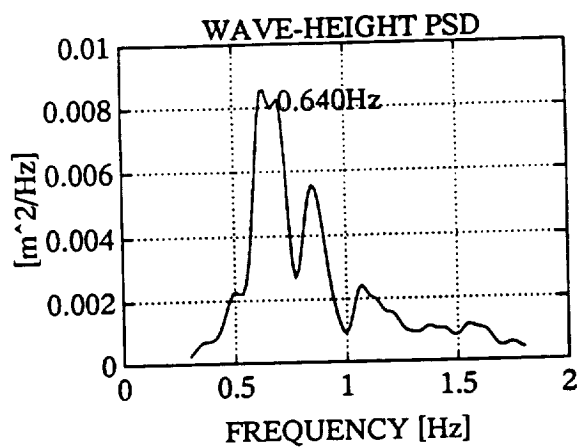
Aug. 4, 1989, Run Time : 18:41:28, Run # 29, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



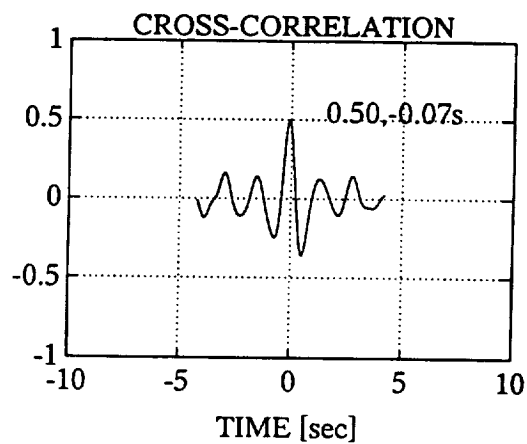
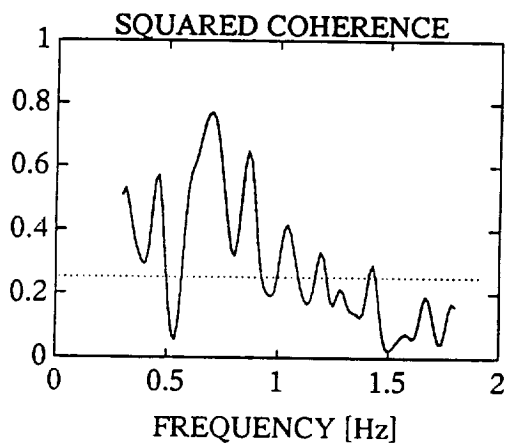
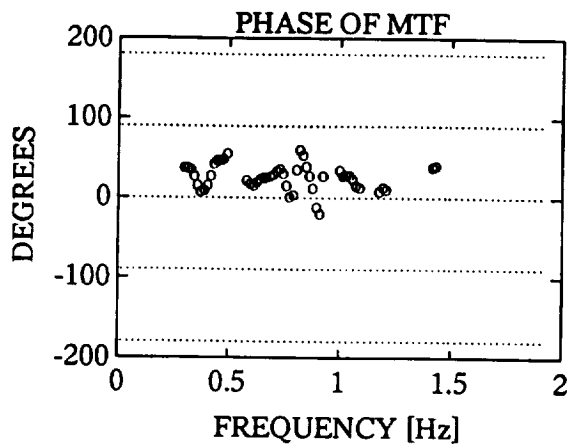
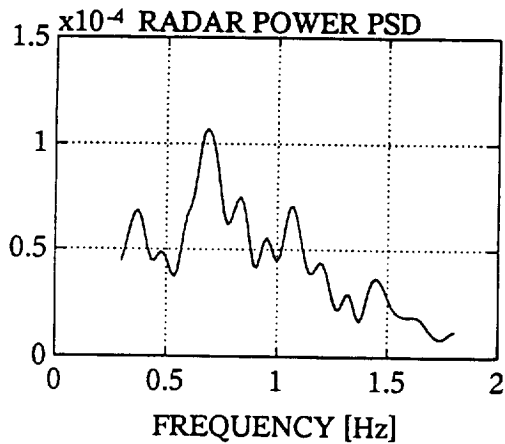
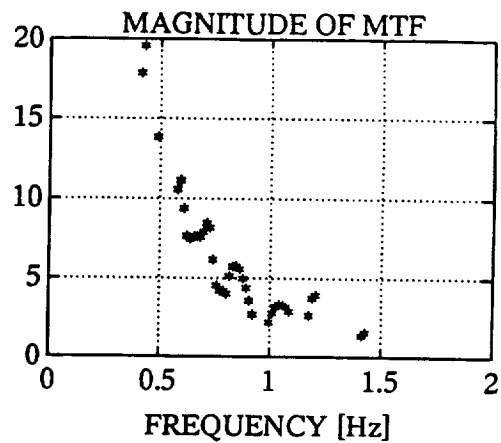
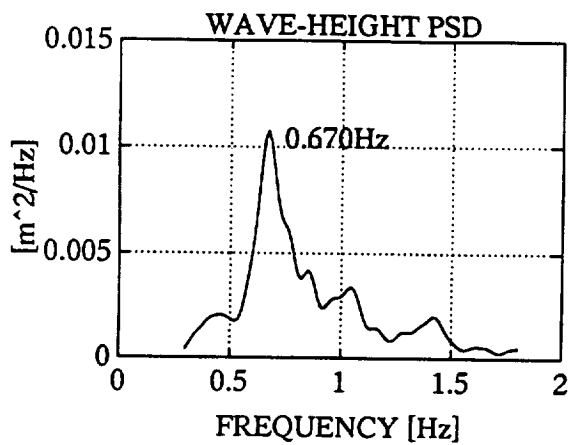
Aug. 4, 1989, Run Time : 18:41:28, Run # 29, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.86 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



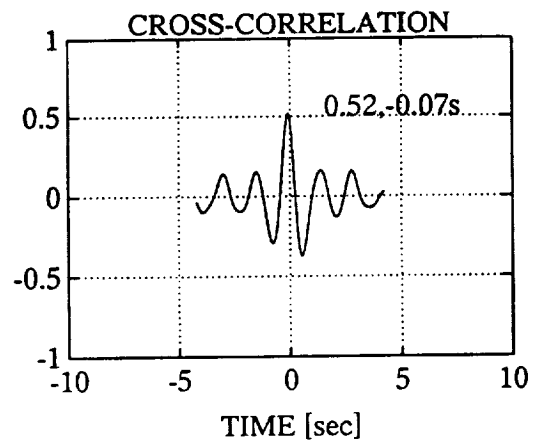
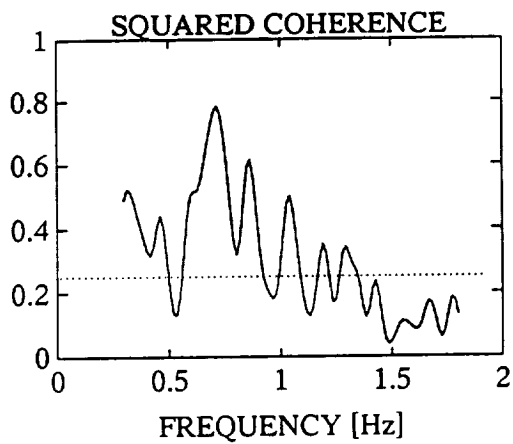
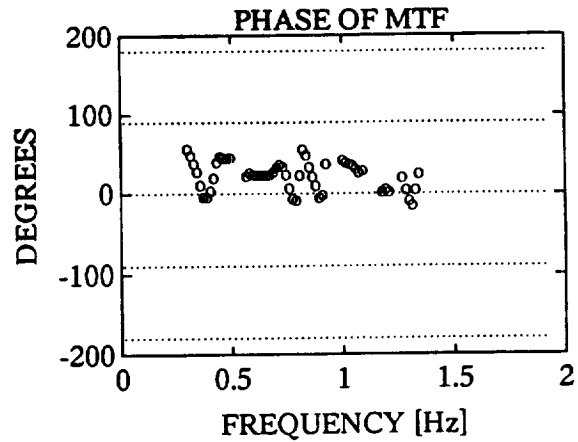
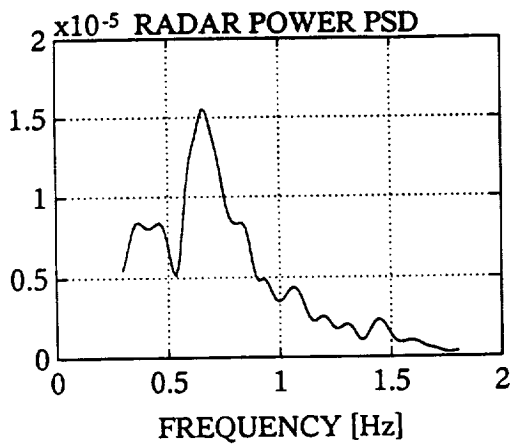
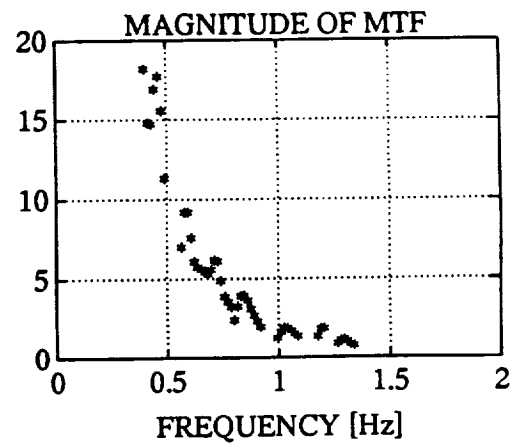
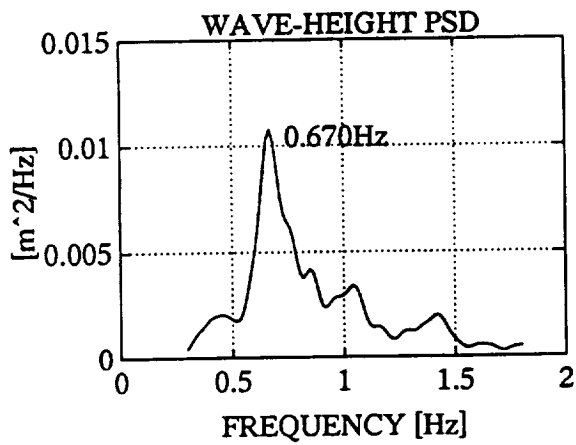
Aug. 4, 1989, Run Time : 19: 0:44, Run # 32, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.87 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



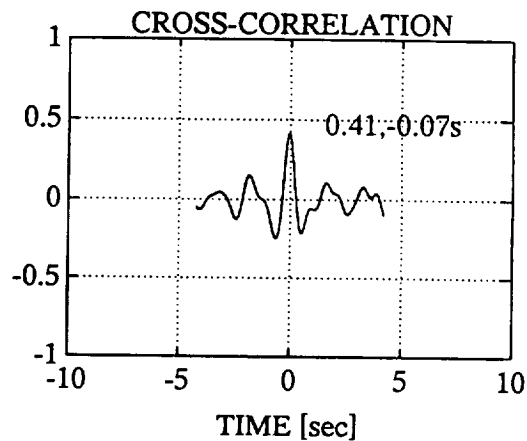
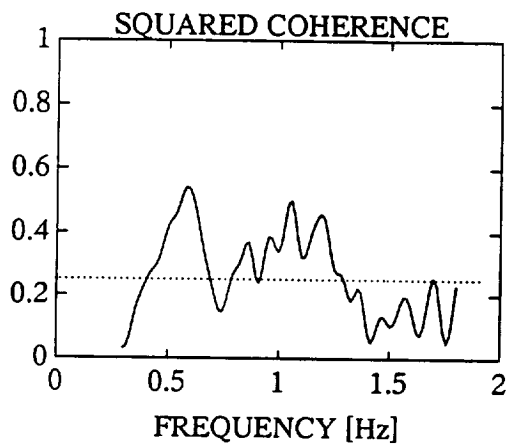
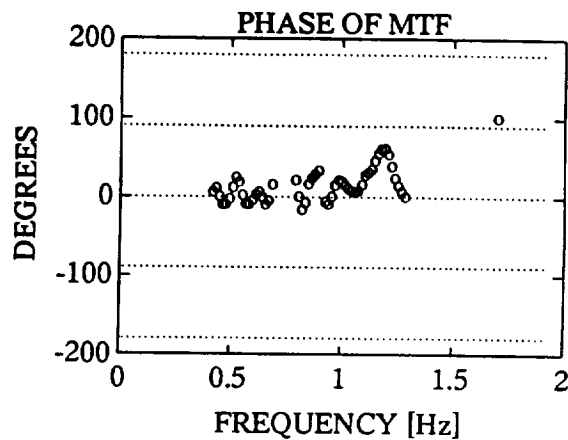
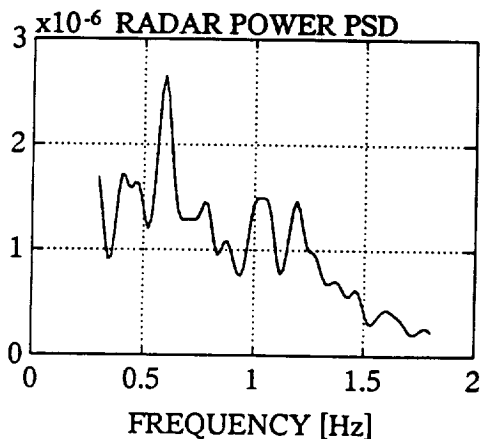
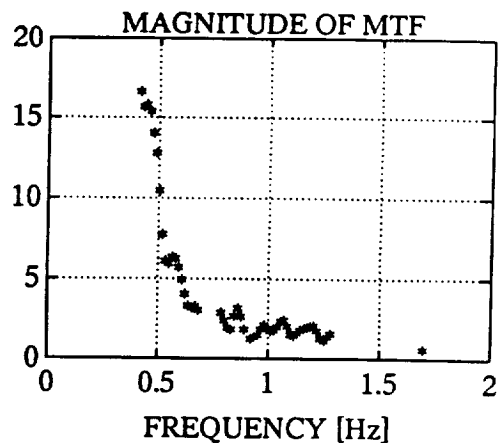
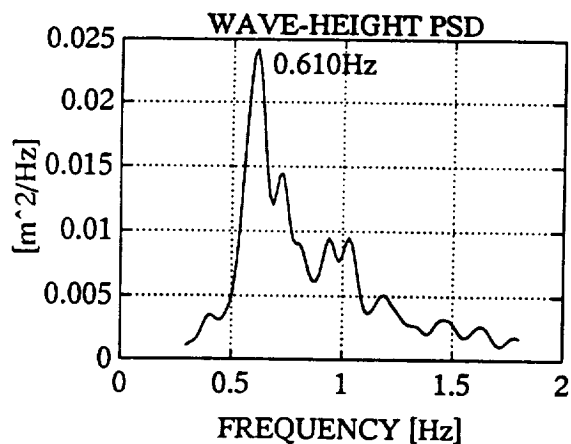
Aug. 4, 1989, Run Time : 19: 0:44, Run # 32, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.87 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



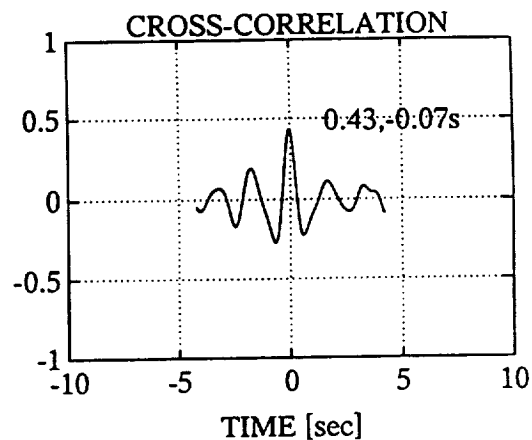
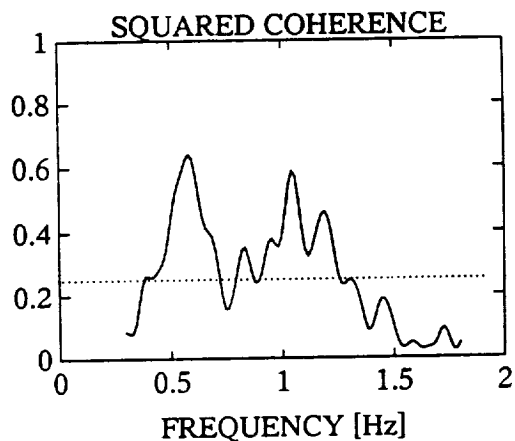
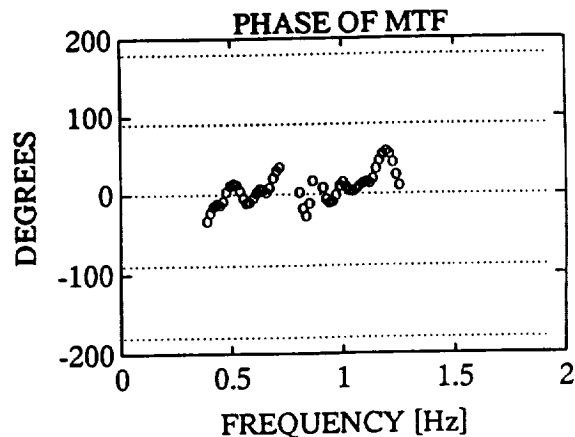
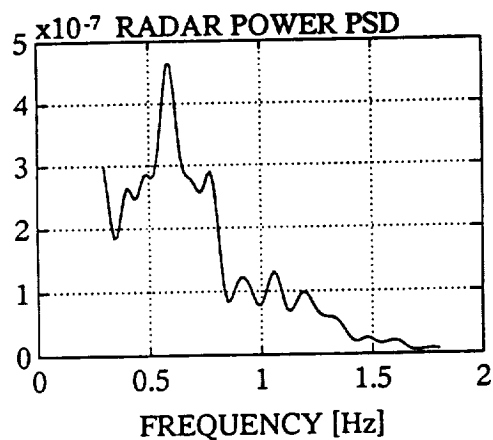
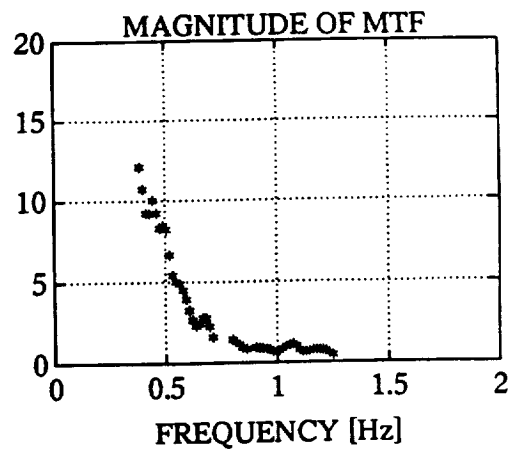
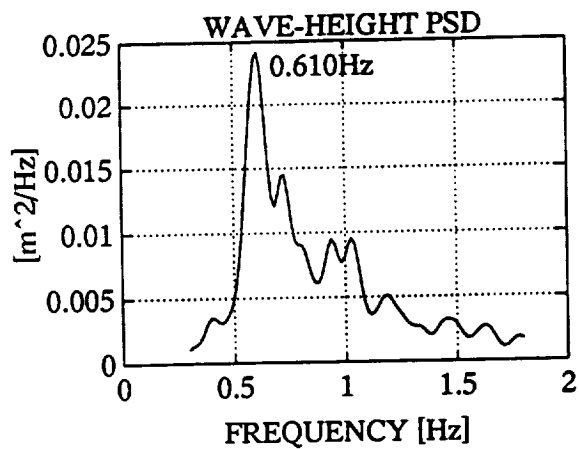
Aug. 4, 1989, Run Time : 19: 6:20, Run # 33, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.83 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



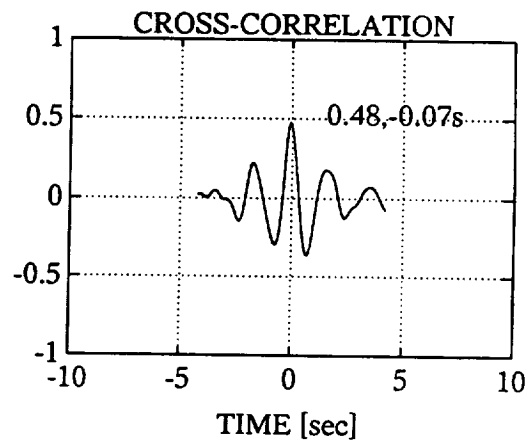
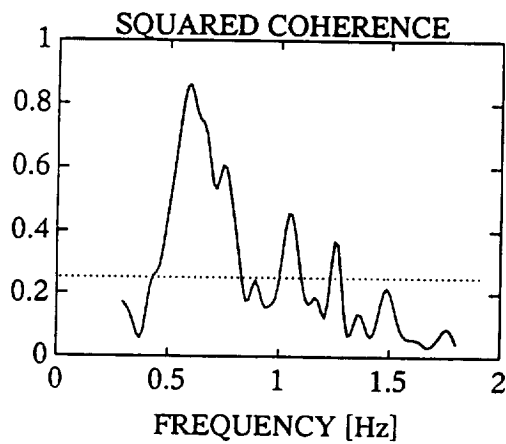
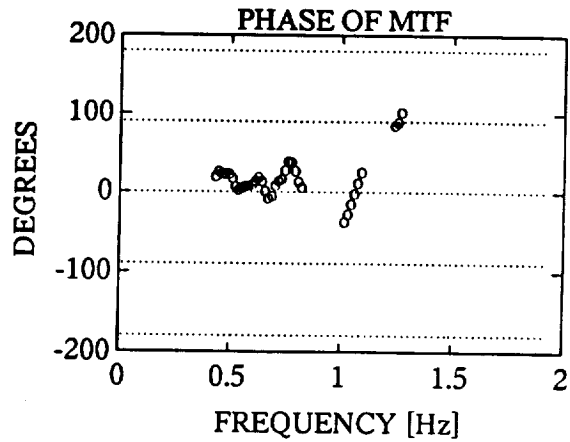
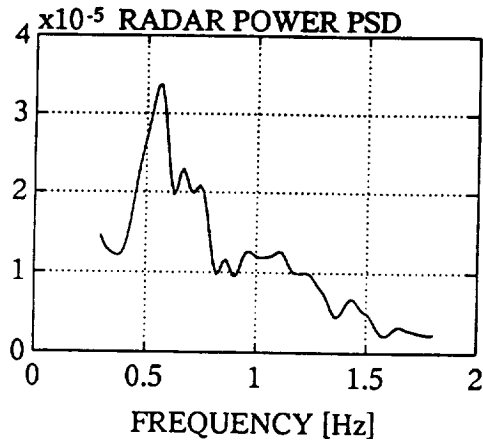
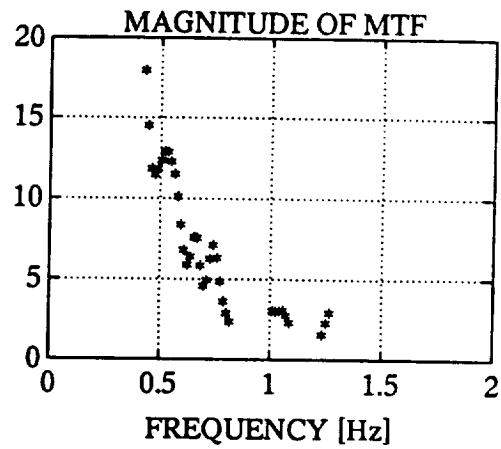
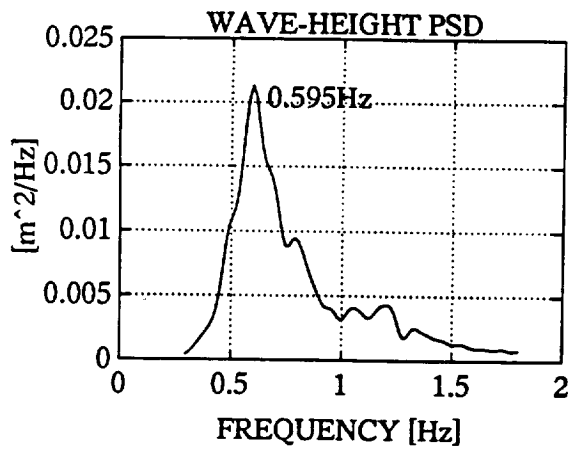
Aug. 4, 1989, Run Time : 19: 6:20, Run # 33, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 3.83 m/s, Air Temp. : 22.9 deg C, Water Temp. : 22.0 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



Aug. 4, 1989, Run Time : 20:40: 0, Run # 42, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.40 m/s, Air Temp. : 20.4 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : 60 deg., Spikes Present

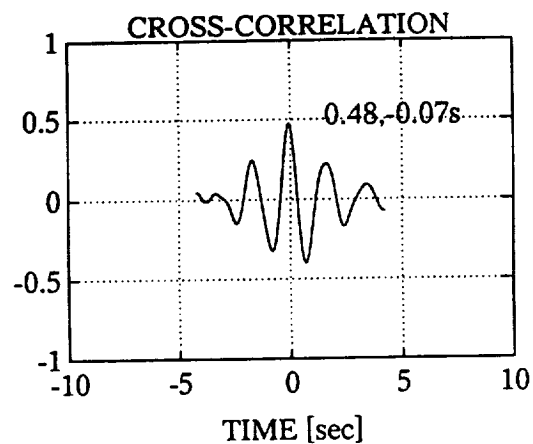
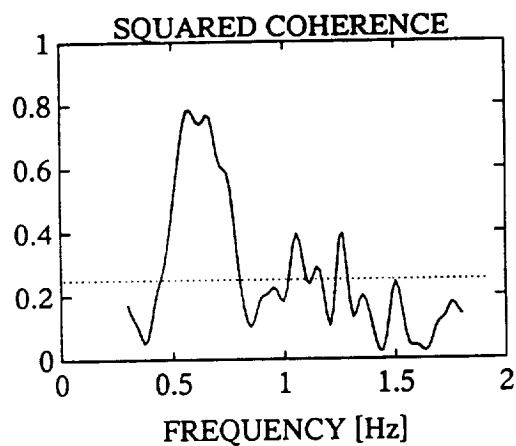
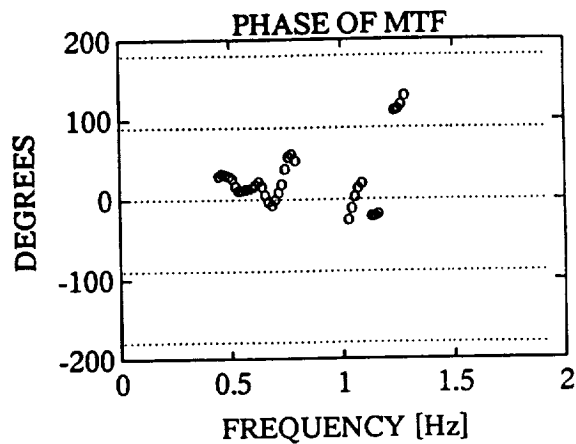
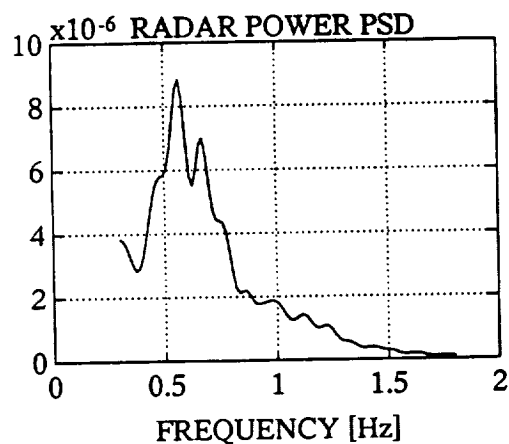
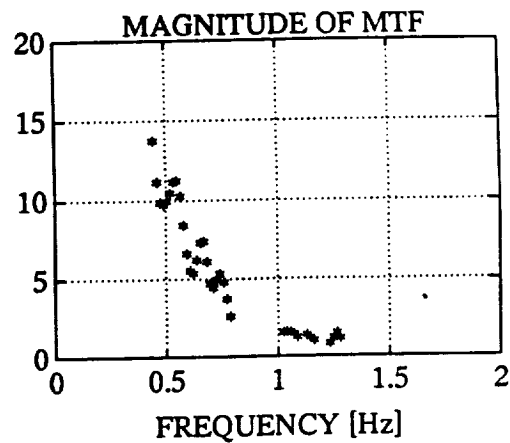
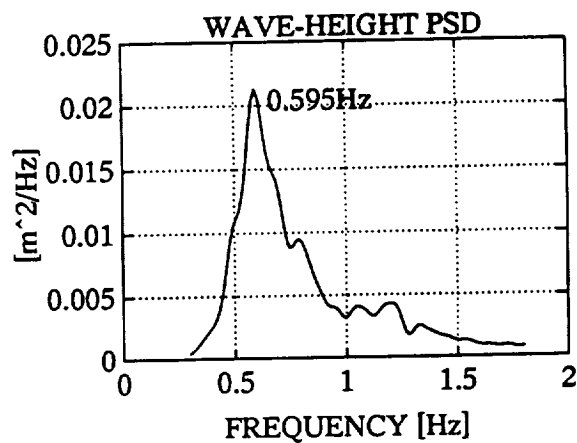


Aug. 4, 1989, Run Time : 20:40: 0, Run # 42, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.40 m/s, Air Temp. : 20.4 deg C, Water Temp. : 21.8 deg C
 Antenna Look Dir. : 60 deg., Spikes Removed (4.5 dB Moving Agerage Threshold)

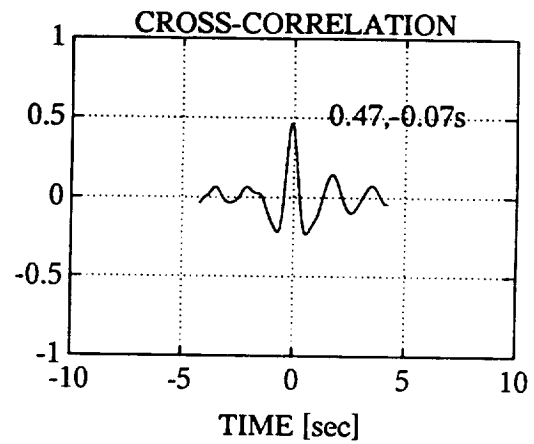
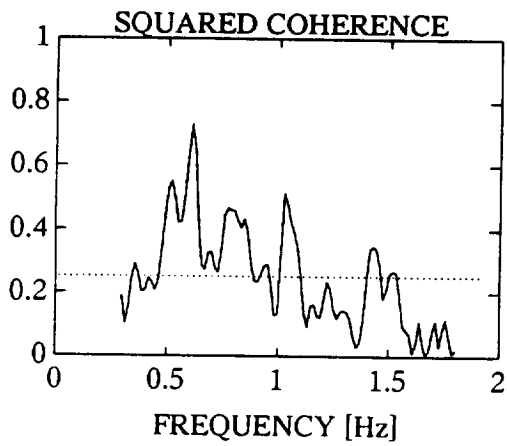
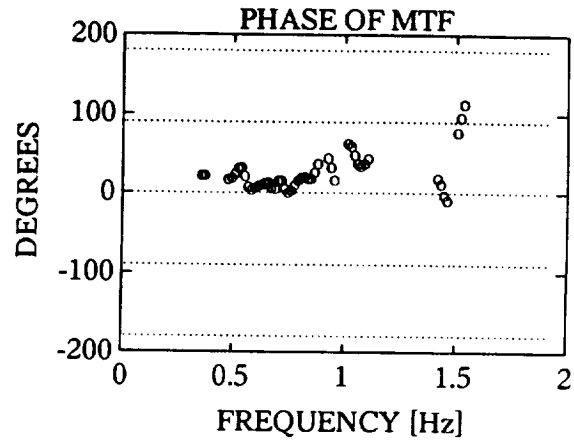
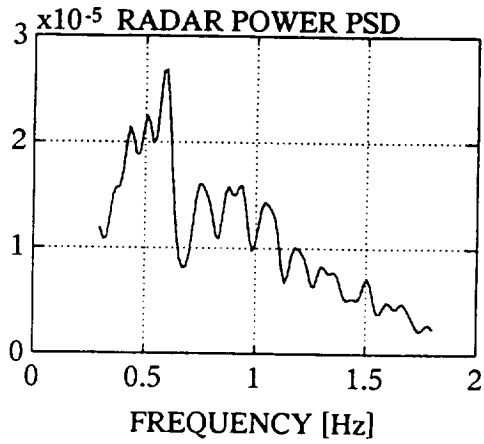
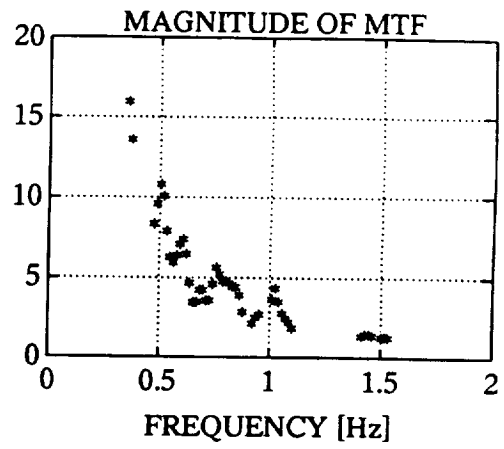
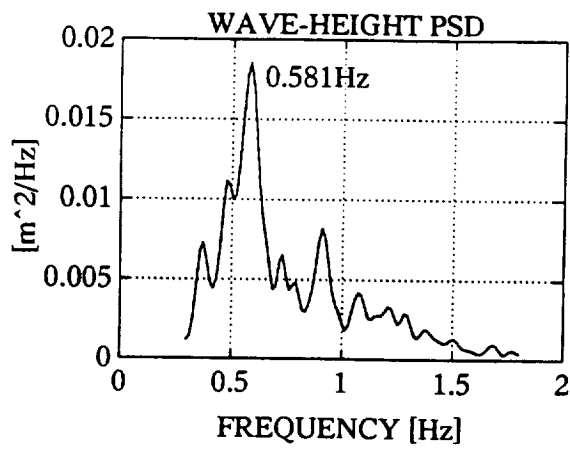


Aug. 6, 1989, Run Time : 17:55:42, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.9 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present

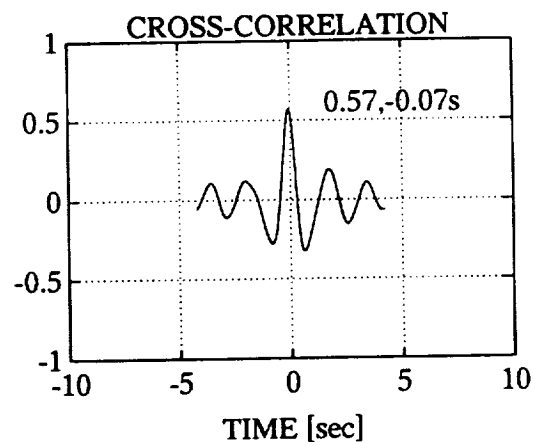
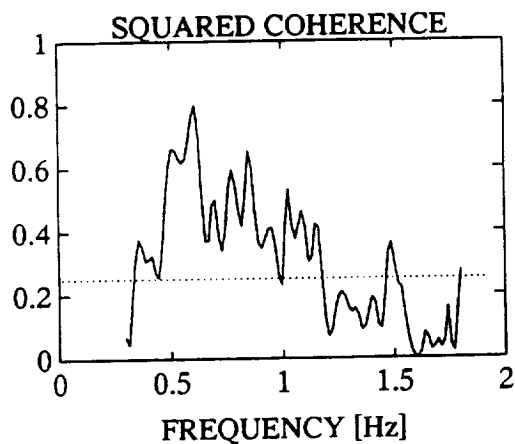
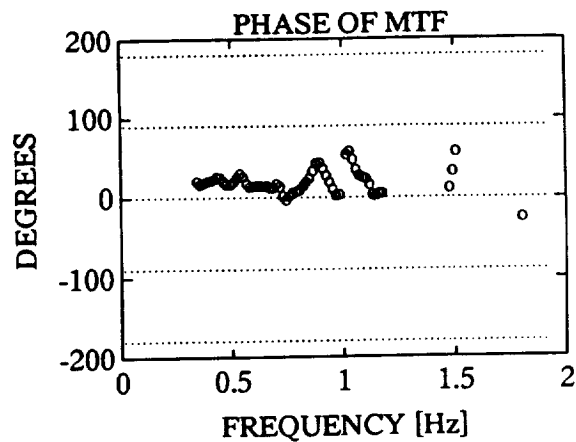
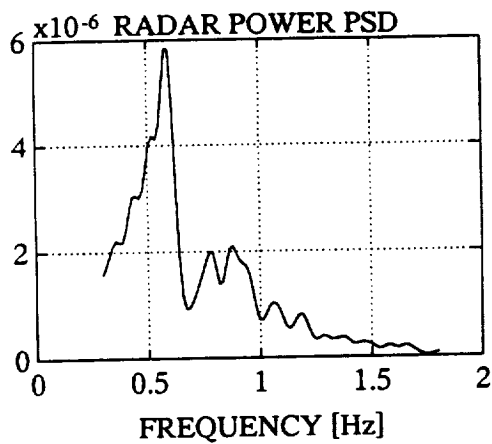
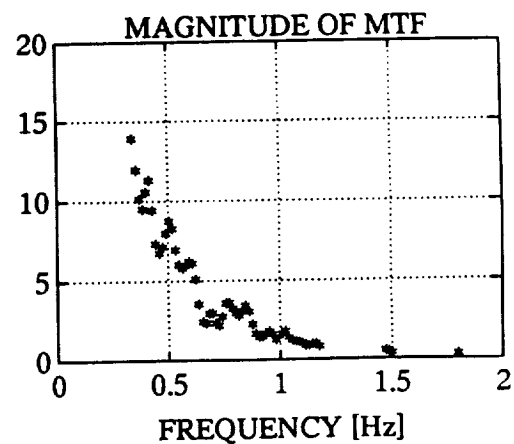
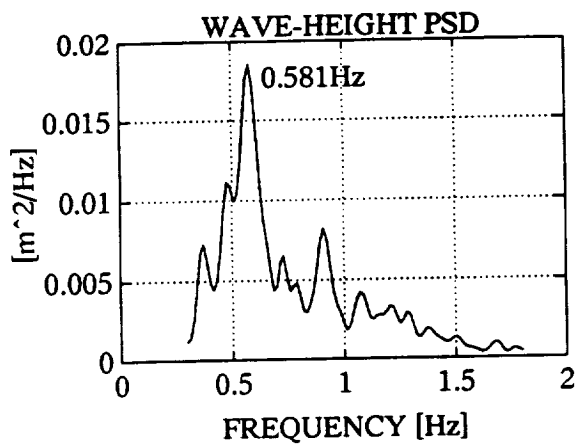
c-4



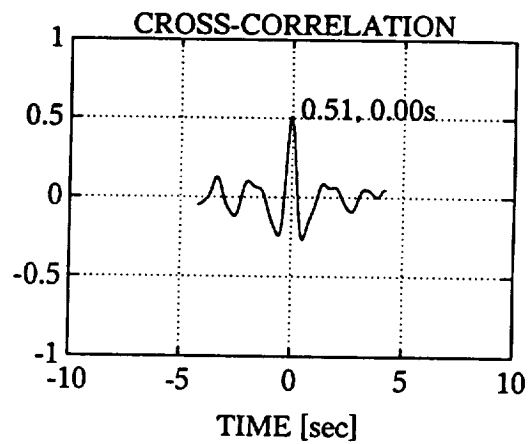
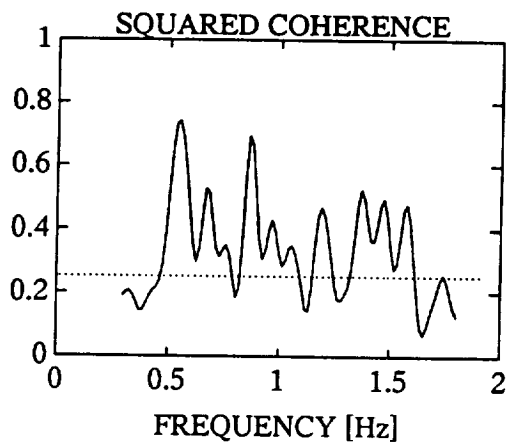
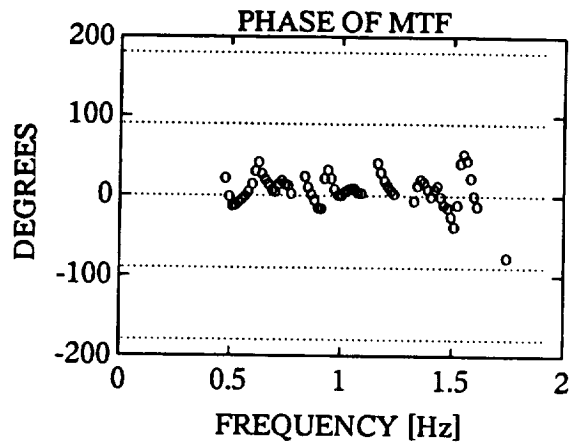
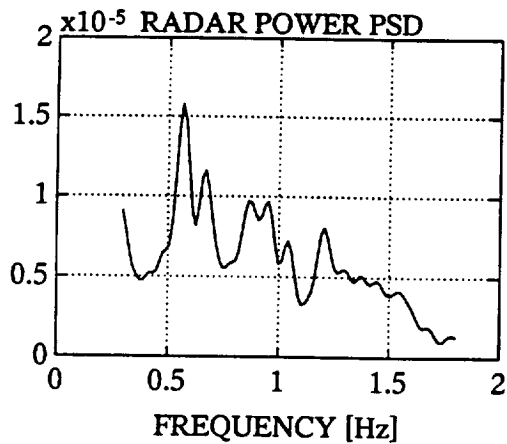
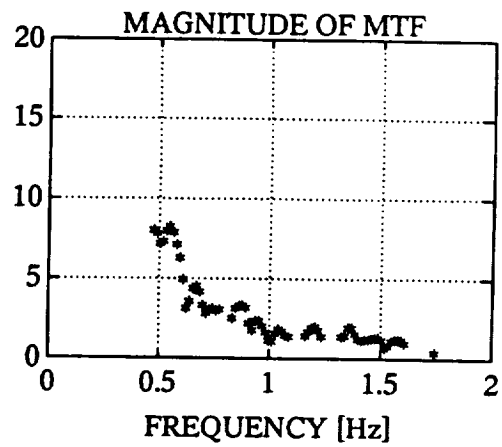
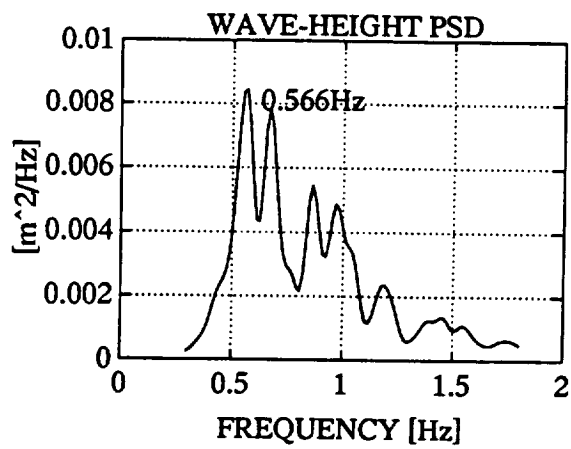
Aug. 6, 1989, Run Time : 17:55:42, Run # 15, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 5.18 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.9 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



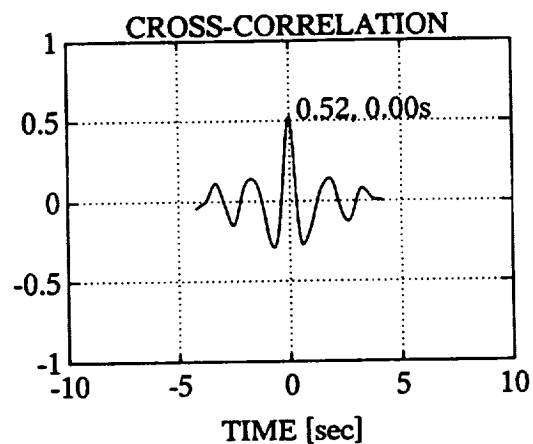
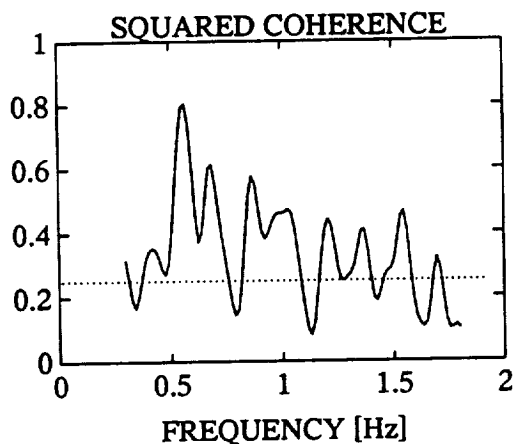
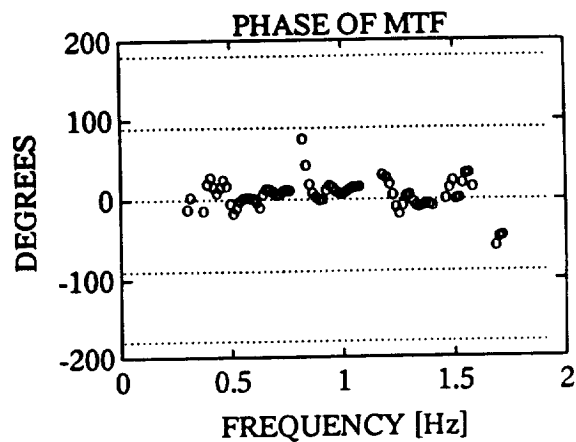
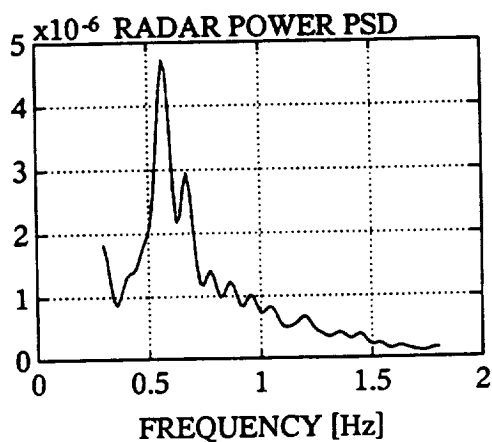
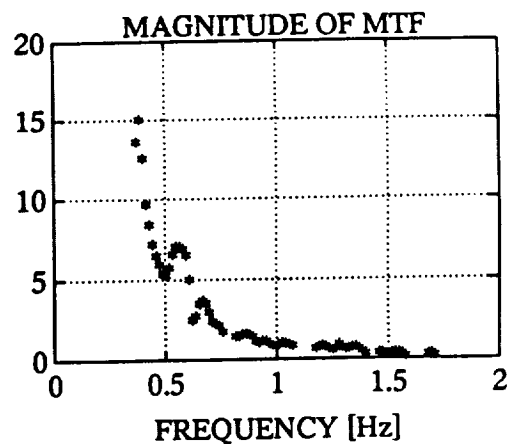
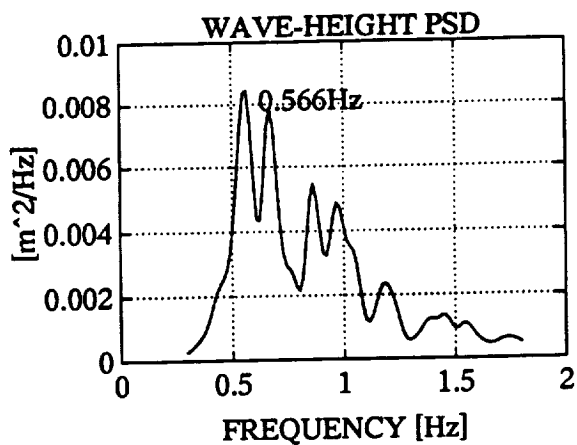
Aug. 6, 1989, Run Time : 18: 3:25, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.82 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.8 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



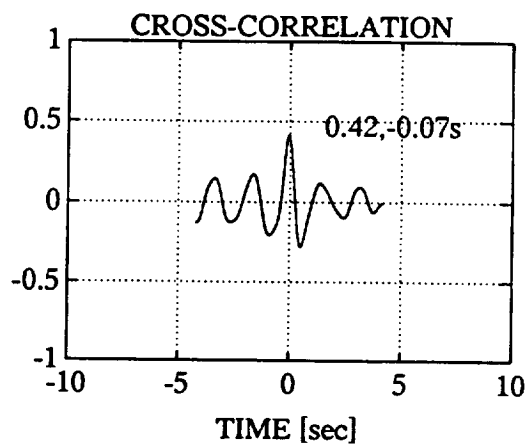
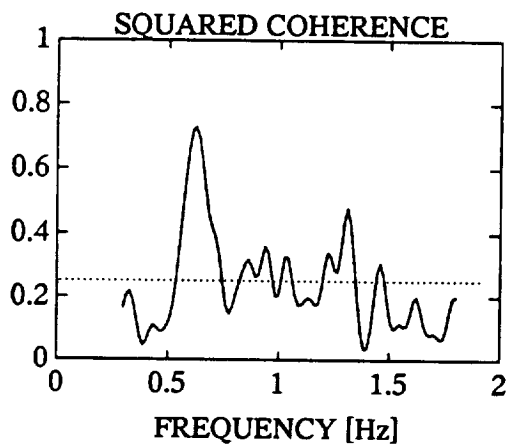
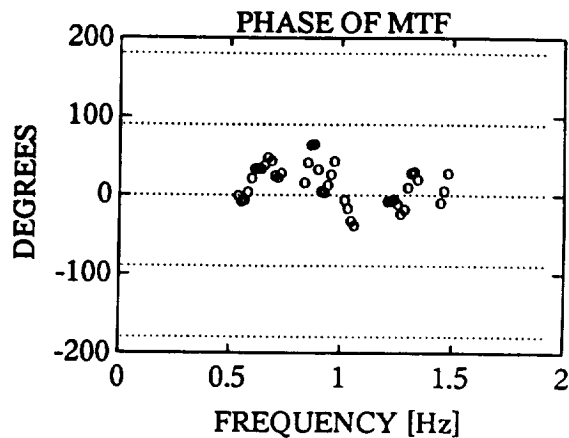
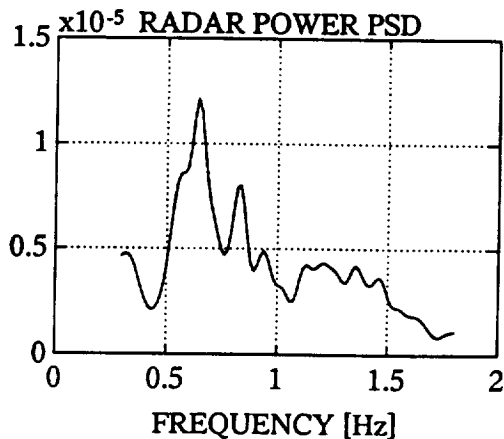
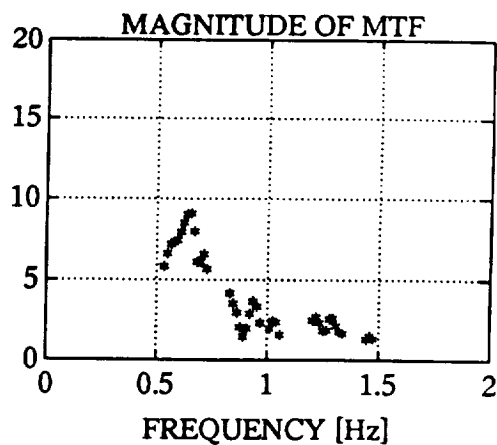
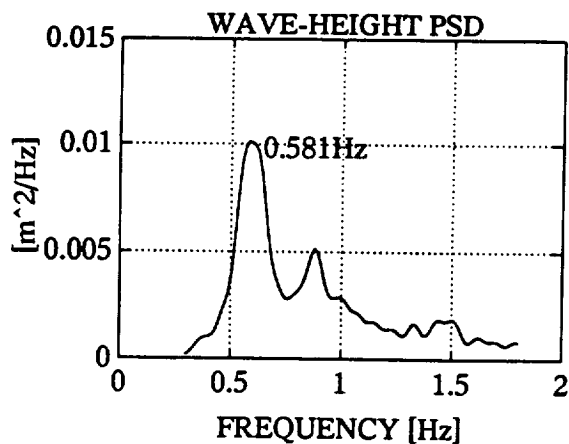
Aug. 6, 1989, Run Time : 18: 3:25, Run # 16, X Band, VV Polarization, 34.0 deg. Incidence
 WindSpeed : 4.82 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.8 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



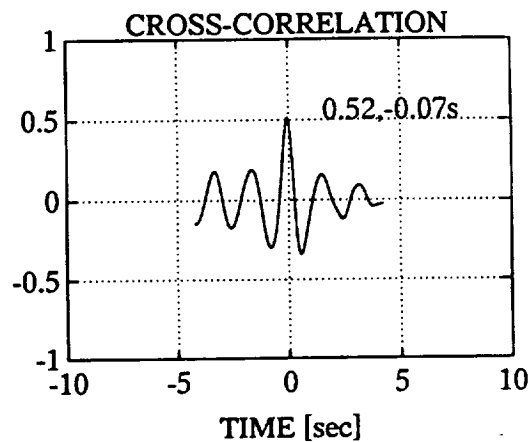
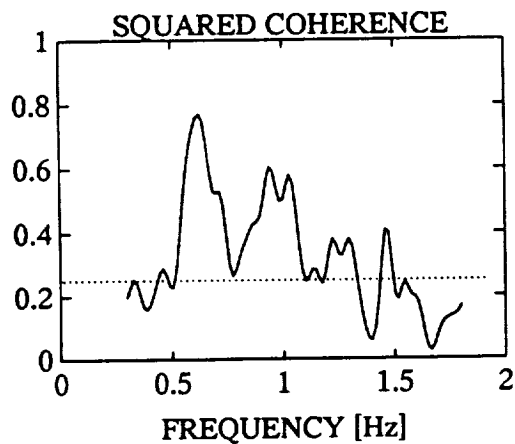
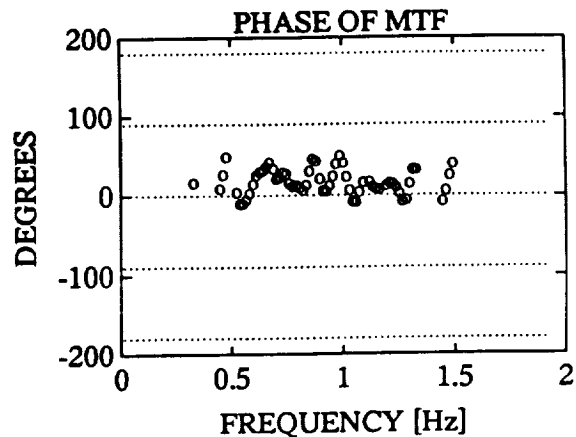
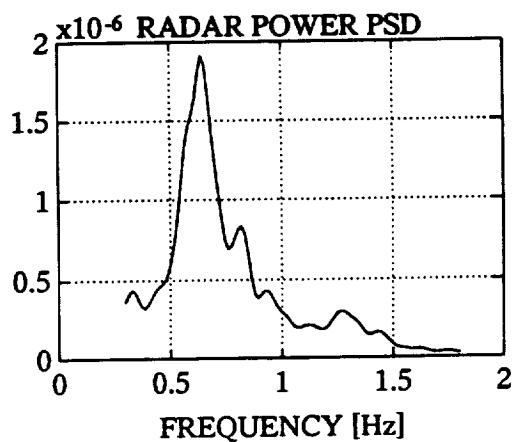
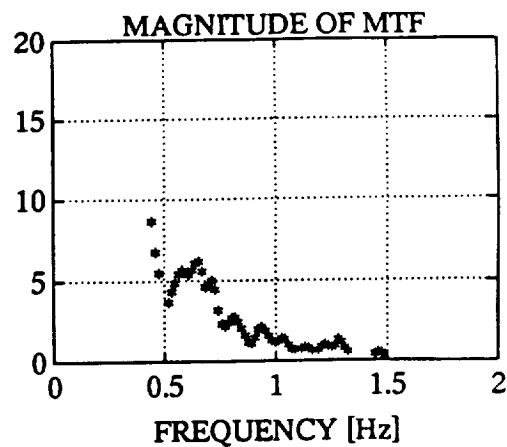
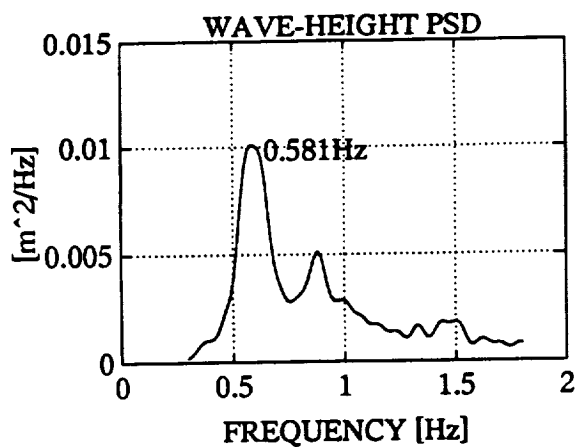
Aug. 7, 1989, Run Time : 17:59:19, Run # 11, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 5.19 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Present



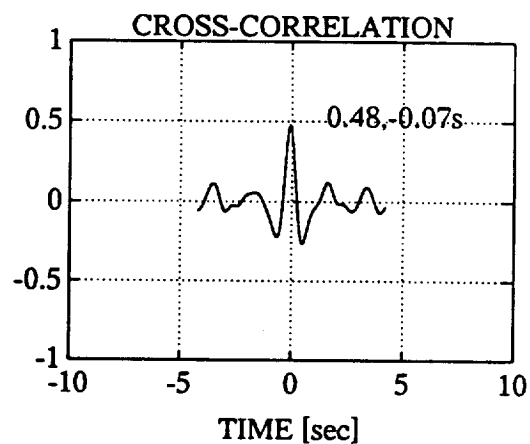
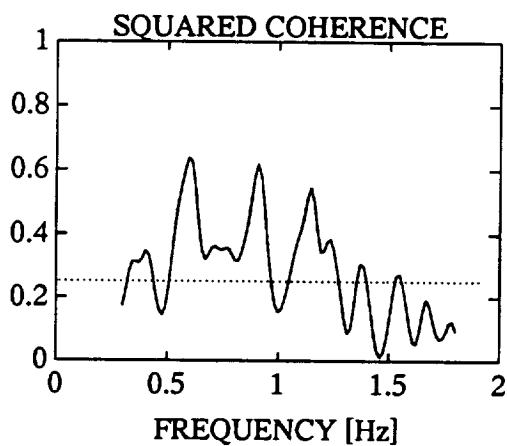
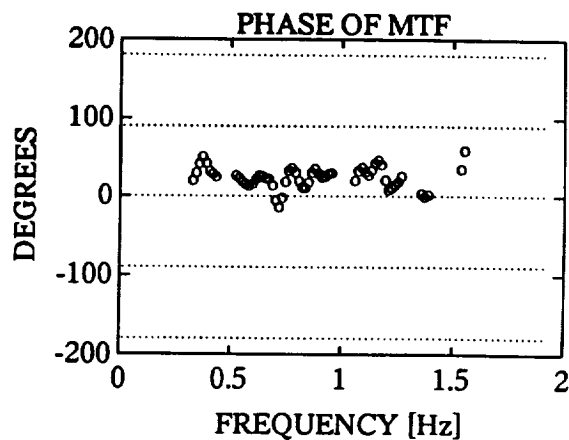
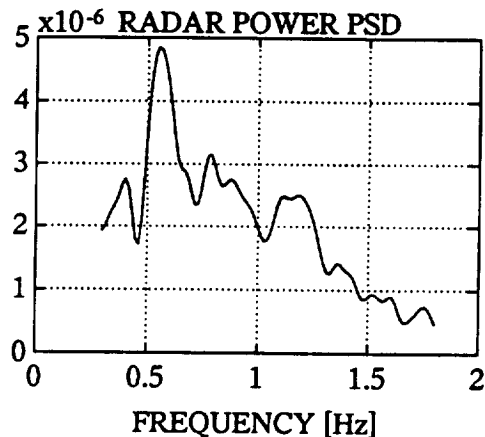
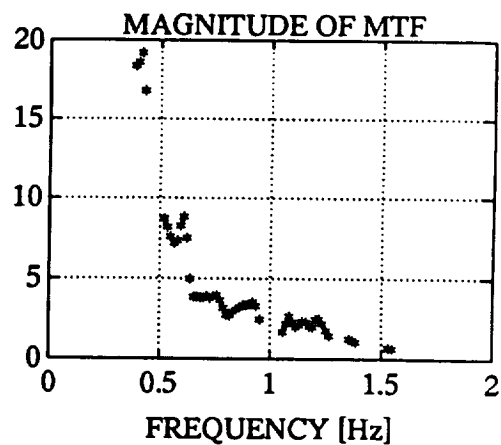
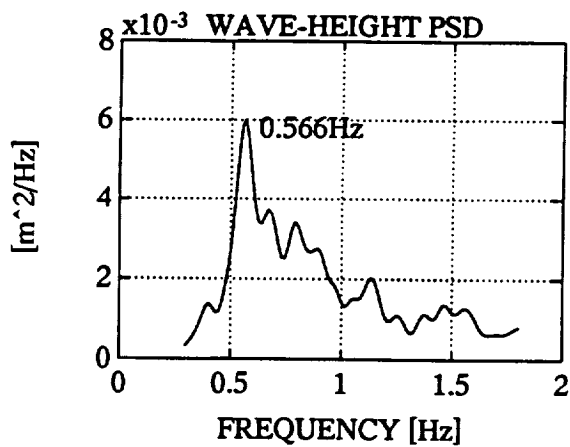
Aug. 7, 1989, Run Time : 17:59:19, Run # 11, X Band, HH Polarization, 34.0 deg. Incidence
 WindSpeed : 5.19 m/s, Air Temp. : 24.9 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Cross-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



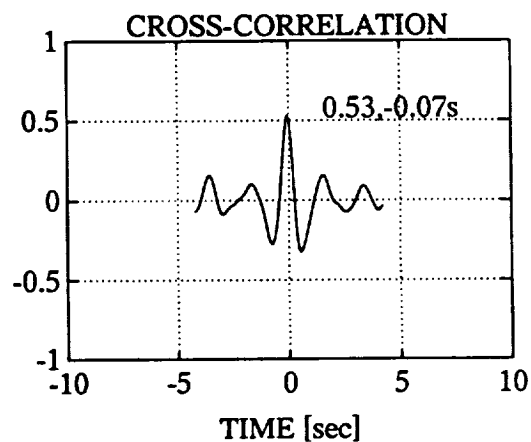
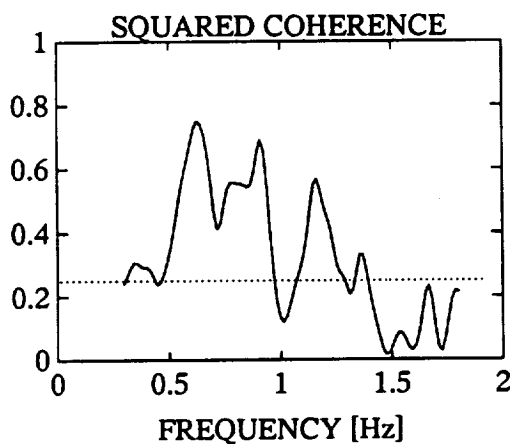
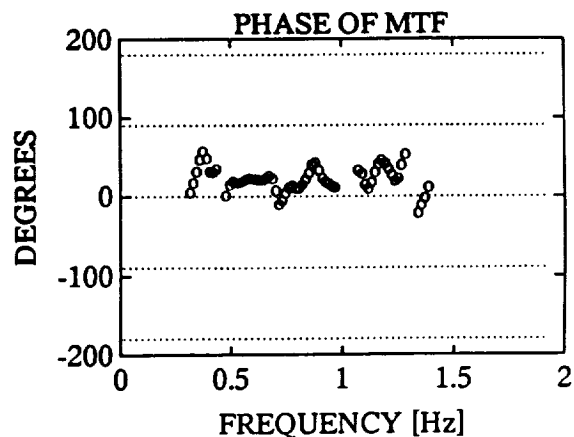
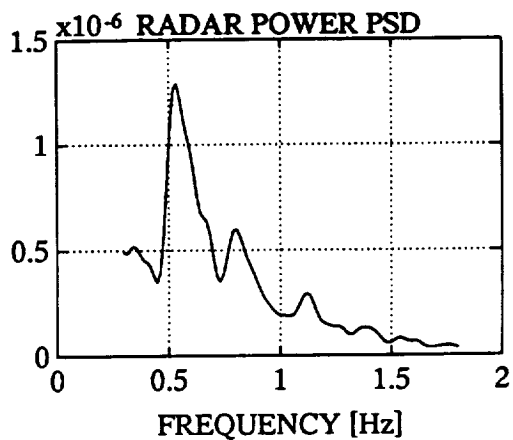
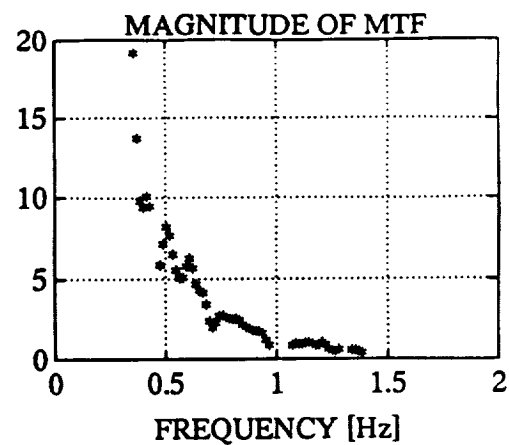
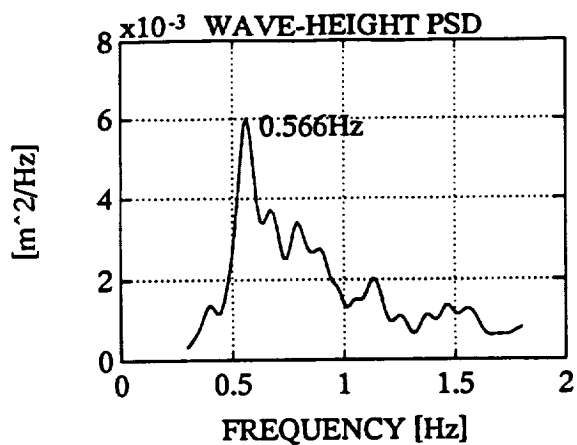
Aug. 7, 1989, Run Time : 18:34: 4, Run # 12, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.36 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



Aug. 7, 1989, Run Time : 18:34: 4, Run # 12, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.36 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.3 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)



Aug. 7, 1989, Run Time : 18:45: 5, Run # 14, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.84 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Present



Aug. 7, 1989, Run Time : 18:45: 5, Run # 14, X Band, VV Polarization, 40.0 deg. Incidence
 WindSpeed : 4.84 m/s, Air Temp. : 24.4 deg C, Water Temp. : 22.2 deg C
 Antenna Look Dir. : Up-Wind, Spikes Removed (4.5 dB Moving Agerage Threshold)

